Nature Magazine

AUGUST-SEPTEMBER
1955

VOLUME 48 NUMBER 7

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A bullet sang through her sleeve

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For some years Mrs. Elizabeth Alexandria Morton Tilton of Southampton, Long Island, New York, has watched the natural features of Long Island give way to commercial development. She resolved to bend every effort to preserve areas as yet undisturbed. Her resolution took one manifestation in the presentation of Jessup's Point to the U. S. Fish and Wildlife Service for a refuge. This spot has long attracted several species of migratory waterfowl, and richly vegetated shoal waters provide excellent feeding area. Aside from clearing and planting mainland fields to provide green food for Canada geese, the gift of 112 acres will be preserved in its natural state.

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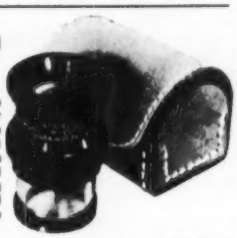

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Bulletins

"In Your Service: The Work of Uncle Sam's Forest Rangers" is a new, illustrated booklet, the title of which is descriptive. It is available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., for 20 cents.

"Misguided Missiles" is the title of the 21st edition of the highway safety booklet issued by The Travelers Insurance Companies, Hartford, Connecticut. In cartoon and statistics it pictures the problems of highway safety.

"The American Tree Farmer" is published by American Forest Products Industries, Inc., 1816 N Street, N.W., Washington 6, D.C. as a report on the progress of the Tree Farm movement fostered by this organization.

The January-February "Information Report" of the Animal Welfare Institute, 350 Fifth Avenue, New York 1, N.Y., contains a report on the incredible and inexcusable cruelty to monkeys being flown in from India for experimental purposes.

"The Bard of Greenbush" is a biography of Samuel Woodworth, Massachusetts poet and author of *The Old Oaken Bucket*. This 20-page pamphlet is the work of William Gould (Cap'n Bill) Vinal and is a Vinehall Publication, Norwell, Massachusetts, selling for fifty cents.

"The Genus Clarkia" is a 150-page booklet on this plant genus. It is the work of Harlan Lewis and Margaret Ensign Lewis and is published by the University of California Press, Berkeley 4, California, at two dollars.

"Point Lobos Reserve" is a 96-page bulletin edited by Aubrey Drury and subtitled "Interpretation of a Primitive Landscape." This excellent illustrated discussion of this fine California State Park is for sale at one dollar, plus tax, (3 cents) by the Printing Division, State of California, Sacramento 14, California.

"Pet Hamsters" is a 28-page, illustrated booklet on the care and training of hamsters as pets. It is published by All-Pets Books, Inc., Fond du Lac, Wisconsin, at thirty-five cents.

"How to Make a Neighborhood Wildlife Album" by Vinson Brown is a 16-page bulletin published by Naturegraph Co., Rt. 1, Box 190A, San Martin, California, and is available at fifty cents.

"Wood-Frame House Construction" by L. O. Anderson and O. C. Heyer is a 235-page, paper-covered publication, illustrated by plans, and published as Agriculture Handbook No. 73, and available from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for sixty-five cents.

"Free and Inexpensive Learning Materials" is published in a sixth edition by the Division of Surveys and Field Services, George Peabody College for Teachers, Nashville 5, Tennessee. It is available for $1.00.

"Perkie Plants" is a 24-page booklet descriptive of Ivy Hill Forest, Cockeysville, Maryland, which is dedicated to conservation. The booklet describes the plants available there and is a most distinctive catalog.

A new illustrated map and guide to Rock Creek Park in the District of Columbia has been prepared by Robert Shosteck and Stephen Kraft. It shows roads, footpaths, Nature trails, scenic and historic points, bridle paths, picnic and recreational facilities and bus routes. It is available from Robert Shostek, Route 1, Brookeville, Maryland, for 35 cents.

Most recent Cornell Rural School leaflet to come to hand is "Summer Nature Explorations" by Eva L. Gordon. Free to New Yorkers, 25 cents to others, from Department of Rural Education, Cornell University, Ithaca, New York.

Cahalane to N.Y.

For the past fifteen years Victor H. Cahalane has headed the wildlife management program of the National Park Service, making an outstanding contribution in that post. He joined the Service in 1930 as a field biologist, is the author of several books and many papers, and has lectured extensively on national parks. Mr. Cahalane has resigned his post with the Federal Government to take over the position of assistant director of the New York State Museum in Albany, New York.

Films

Sterling Educational Films has spent a year re-evaluating and classifying its 16mm non-theatrical film library. New titles have been added and a catalog reflecting this work has been issued. It is available on request from Sterling Educational Films, 205 East 43rd Street, New York 17, N. Y.

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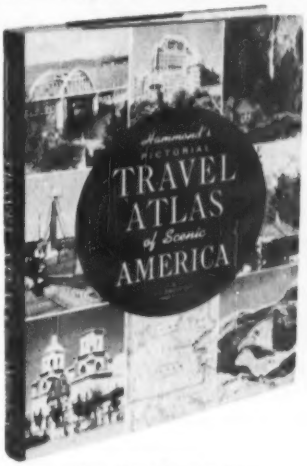

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Nature IN PRINT

By HOWARD ZAHNISER

National Forests

ABOUT HALF A CENTURY AGO, A tailor from Manhattan's lower East Side in New York City, from down near the Williamsburg Bridge, might have been seen tramping off across Long Island, or perhaps out to Van Cortlandt Park, on a Sunday outing to the country, with a lad—his young son—on his back, or scampering along beside him. The father, himself raised in a rural village in Esthonia and, for all his metropolitan ways, a lover of the wild woods and the fields, would surely chuckle with satisfaction, now, could he realize that his love of the countryside had so infused this young lad that these early excursions later extended themselves into the forests of all the forty-eight States in this marvellous land to which the father had emigrated.

At the age of five the boy and his family moved to Brooklyn. At twelve he was a Boy Scout, in a troop that really hiked—often eighteen miles a day, he remembers. By the age of fourteen he had made up his mind to be a forester, and so he has become—by way of the Brooklyn Evening High School, New York's City College, Cornell University, the Adirondack lumber camps, Canadian woods, and a sequence of desks. He received a master's degree in forestry at Cornell, and later studied land economics at the University of Wisconsin. He was once in charge of forest investigations for the Tennessee Valley Authority and for a time was the Authority's chief assistant forester. For a quarter of a century he has been a part of the great U. S. Forest Service, conducting research on land use and watershed management, and since 1945 he has been assistant chief of that Service's division of forestry influences. Forestry has, indeed, been his career, and within it the national forests have been his deepest concern. For the time being this career reaches a brilliant climax in a most interesting and significant 1955 volume, entitled *Our National Forests*, and one who knows its author and the appealing history of these early boyhood excursions with his father, on those Sunday rambles away from the Manhattan or Brooklyn tailor shops, can hardly hold the book in hand without wishing at least to conjure up for a moment the father's delight at how far the forestry son has come from the few trees of Brooklyn.

One cannot hold a biography to a paragraph or two, of course, or introduce a book in a brief review with a full account of the author's life. It is enough, perhaps, to indicate as much of the writer's experiences as are pertinent to the volume's acceptance and understanding, and, perhaps, these are already thus adequately suggested. The central biographical thought that is important here regarding Bernard Frank—this author of *Our National Forests*—is that he not only is a trained and experienced forester but also that he is a man of cosmopolitan origins, a person with wide sympathies and broad understandings.

FRAUD

Here, flat in summer's grass I lie,
Studying the patterned sky,
Letting sunlight through the trees
Lull to sleep my memories;
Hearing, as he blindly comes,
How the striped invader hums:
Poised above a flower, he
Pretends he is the Busy Bee,
But to me his lazy hover
Denotes another nature-lover!

Ray Romine

This biographical thought is of more than curious interest because this book is outstandingly interesting and significant largely because it realizes in its interpretation of the national forests, not alone their value as producers of wood and wood products, but also their living meaning to the thousands of people who look to them as sources of water supplies and who seek them out as sources of recreation and inspiration as well. All in all one can hardly read and ponder *Our National Forests* without concluding with enthusiasm that its author—Bernard Frank—is an inspired interpreter indeed. Added to his multiple sensibilities to the values of the forests is likewise a zeal for the public welfare that instinctively holds sacred the benefits to the public that come, or ought to come, with ownership of the forests. Thus the book, in reality as well as in name, becomes concerned with forests that are national and ours.

"All citizens share the ownership of our richly endowed national forests," Mr. Frank emphasizes, and they likewise "share responsibility for safeguarding their integrity." Yet all too few, he realizes, are aware of the values that the forests represent—material or spiritual—and it is a manifest mission of his book to help all who are thus affected and responsible to understand more fully and appreciate more nicely.

Our National Forests, of course, relates the history of the establishment of the national forests and describes the various kinds of forests that make up the system. In a chapter entitled "Ten Thousand Loyal Servants" that is rich in anecdote and personal interest, it tells of the way in which the national forests are administered and protected. It explains the problems in forest protection, and the issues over which protectors and exploiters quarrel. It includes, in appendices, the reference information in factual summaries and lists that one would expect in such a volume. All these inclusions one should, of course, take for granted in a book on the national forests, and perhaps it is enough to comment that Mr. Frank provides them not only thoroughly but in a manner that makes the reading interesting as well as informative.

The heart of Bernard Frank's book on *Our National Forests*, however, over and above all these minimum essentials, is in its magnificent 92-page second chapter entitled "Profit, Pleasure—and Something More," standing out in the volume and in all the literature on the subject as conspicuously as Brahms' Fourth Movement in his

Symphony No. 1. Here, for anyone who exults in the great national forest system that is ours—not only with its timber and its profitable commodities but also with its grandeur of scenery, its beautiful waters, its abundance of wildlife, and its great and extensive still living areas of wilderness—here, indeed, is an expository tribute to enjoy.

On a note of personal experience, this chapter opens with a statement of the theme of multiple use. After this section on "The Multiple Use Idea," it goes on to relate "Soil and Water: Inseparable Resources." With such an introduction comes the section on "Trees for the Future," pointing out that "the national forests contain billions of board feet of timber," but emphasizing that it also is important to know "how the timber is made available, who benefits, and what other values of timber-producing land are recognized in managing the national forests." The tension in this second chapter mounts in two middle sections in which grazing opportunities and conditions in the national forests are discussed under the title "Discord on the Public Ranges," and a consideration of "Mining Claims: A Rising Threat" concludes with the warning: "It seems certain that unless the present mining laws are quickly modernized, we face the irreparable loss of a large part of our national forest resources."

A more pleasant tone characterizes the next section, on "Promoting Fish and Wildlife," the story of the national forests as proving grounds for wildlife management, programs with value that "cannot be measured adequately in dollars" but that nevertheless "add precious strength and stability to the American way of life." This section's mood lasts on into the next section, a section that begins "One of my favorite recreational haunts is the George Washington National Forest in Virginia and West Virginia, a four hour's drive or less from the nation's capital"—and then goes on to describe "Forests for Pleasure."

In the final sections of this chapter, however, are obviously the sources of the author's greatest satisfactions in the forests. One feels that the deepest of these are expressed in some of the eloquent paragraphs of the section on "Science Helps the Forest" that relates the forest, range, and watershed research in which the author has been a participant in the national forests to "the ever widening horizons of our knowledge that concerns the relations of water, land, and people" . . . the knowledge that helps us "understand a little better our relationships with each other and with the world about us." Yet the final exposition of this great chapter on "Profit, Pleasure—and Something More" is entitled "Solitude and Inspiration" and deals with the great wilderness resource of the national forests that Bernard Frank regards so highly and for which he has become such an effective champion.

"Deep-thinking men," he writes, "appalled at the penalties we pay for mechanical living, turn gratefully to the hardships and solitude of the wilderness." And Mr. Frank then quotes Supreme Court Justice William O. Douglas, who contributed a foreword to this volume and in his own *Of Men and Mountains* testified that "when man ventures into the wilderness, climbs the ridges, and sleeps in the forest, he comes in close communion with his Creator. . . . He taps inner springs of his strength. He comes to know himself." Indeed, within the 79 wilderness, wild, primitive, and roadless areas are some of the greatest treasures of the national forests, and it is a hallmark of Bernard Frank's volume that the values of the wilderness are honored in the conclusion of the book's magnificent Chapter Two.

It is my impression that there are many, many readers to whom *Our National Forests* will come with inspiration and pleasure and with the satisfaction that accompanies sound information faithfully interpreted. I only wish I could see it held in the hand of that Manhattan tailor from Esthonia who started its author out of the Lower East Side across Brooklyn and Long Island and off and away to all these marvellous national forests of which it tells.

Our National Forests. By Bernard Frank. Norman: University of Oklahoma Press. 1955. xx + 238 pp. (6-1/8 by 9-1/4 in.) with foreword by William O. Douglas, 48 photographs on 32 plates, map showing national forests and runoff in the United States, organization chart of the national forests, appendices including national forest recreational and scientific resources listed by state and forest, and index. $4.

The Bird Book

By Leon Augustus Hausman. New York. 1955. Arco Publishing Company. 156 pages. Illustrated in black and white, with 16 color plates from Audubon prints. $2.00. This book is not likely to supplant Peterson, Pough or others as a field guide to the birds. It illustrates, through photograph or drawing, 362 bird species, each illustration supplemented by a relatively brief and popular text. In an introductory chapter the author discusses 59 bird families and presents one member of each family. The color in the Audubon reproductions is rather better than average.

Geography of the Northlands

Edited by George H. T. Kimble and Dorothy Good. New York. 1955. John Wiley and Sons. 534 pages. Illustrated. $10.50.

More and more the arctic and the subarctic are looming in importance, both for their economic significance and their position in international relations. It is therefore timely that a textbook about these regions should be made available, particularly since there has not been a comprehensive work in this field of two decades. This present volume is written by a group of specialists in the northland and against their background of recent field research. The arctic and subarctic are approached from the viewpoint of their significance for human habitation. Although a textbook, the editors and contributors have provided a readable book that should be of interest to that overworked individual, the intelligent layman.

Soft-Billed Birds

By Carl Naether, Fond du Lac, Wisconsin. 1955. All-Pets Books, Inc. 64 pages. Illustrated with four color plates and black and white drawings. $3.50.

This is a guide to the care and breeding of those caged birds whose food is primarily soft in character and consists principally of insects and fruits. The author has had long experience with native and foreign soft-bills in aviaries and cages. In this book he seeks mainly to provide practical advice, recognizing that this field of aviculture is a large one and an exhaustive work would require a considerable tome.

Reviews

The American Southwest

By Natt N. Dodge and Herbert S. Zim. New York. 1955. Simon and Schuster. 160 pages. Illustrated in color. Paperbound, $1.00; clothbound, $1.95. In this latest addition to the "Golden Regional Guide" series a surprising amount of informational material has been packed into small space. This little book, a handy and valuable one to have along on a trip to the Southwest, illustrates more than 400 subjects in full color. The text and pictures cover natural wonders, Indian villages, historic sites, scenic routes, guide maps, public parks, minerals, mammals, birds, trees, insects and flowers. The illustrations are by Arch and Miriam Hurford.

Tiger of the Snows

By Tenzing Norgay, in collaboration with James Ramsey Ullman. New York. 1955. G. P. Putnam's Sons. 294 pages. Illustrated. $4.50. In this autobiography Ullman collaborates with Tenzing of Everest, who fought his way to the peak of Everest with Edmund Hillary. It was a dream of this simple, unlettered mountain man of the Himalayas that he should scale the peak near the foot of which he had been born. This is a moving story of Tenzing's youth, his people and the final realization of his dream. To aid him in telling his story he is, of course, fortunate in his collaborator, mountaineer and writer, and one notably equipped to catch and interpret the spirit of Tenzing. This is a fascinating story of a man and of great adventure.

Nature Roundup

By Robert E. Pinkerton. New York. 1955. Harper and Brothers. 246 pages. Illustrations by Jack Bradley. $3.50. For a decade the author has been conducting a question column in *True Magazine*. Answers have been given to some 65,000 queries, and from these he has culled what he regards as the most interesting questions in the field of Nature. The author has grouped these by chapters dealing with mammals, birds, fishes, reptiles, the physical world and outdoor life. Like comparable books by the late George Stimpson, this is an interesting volume to pick up and in which to do a bit of browsing. A good index makes it useful as a reference.

Saga of the Grey Seal

By R. M. Lockley. New York. 1955. Devin-Adair Company. 149 pages. Illustrated. $4.00.

In this book the author shifts from his earlier important reports on the lives of birds of the sea—shearwaters and puffins—to a report on a mammal of the sea—the Atlantic or gray seal. Having observed these animals on the beaches of Wales, and being puzzled by some of the details of their behavior, he decided to spend a breeding season with these seals. It was an adventuresome decision, and a fortunate one for those who find pleasure in authentic and well-written natural history.

Briefly Noted

The Hunting and Exploring Adventures of Theodore Roosevelt. Edited by Donald Day. New York. 1955. The Dial Press. 431 pages. $5.00. An outdoor autobiography of T.R.'s adventuring, particularly hunting.

Bout with Cancer. By Florence Greenhoe Robbins. Boston. 1955. Christopher Publishing House. 112 pages. $2.50. The true story of one woman's successful fight against cancer.

Philosophic History of Civilization. By Jennings C. Wise. New York. 1955. Philosophical Library. 404 pages. $4.75. The author seeks to promote an intellectual revolution in the teaching of history through this work.

Making Things of Plastic. By Lauton Edwards. Peoria 3, Illinois. 1955. Charles A. Bennett Co. 191 pages. Illustrated. $3.75. A practical, how-to-do book for those who like to make things for use and decoration out of plastic materials.

Industrial Recreation. By Jackson M. Anderson. New York. 1955. McGraw-Hill Book Company. 304 pages. Illustrated. $5.00. A guide to the organization and administration of industrial recreation with very minor attention to recreation involving wilderness, Nature and other related recreation.

Barn Swallow. By Paul McCutcheon Sears. New York. 1955. Holiday House. 45 pages. Illustrated by Walter Ferguson. Well done little life-cycle story of these valuable and interesting birds. For the younger reader.

Longhorn: Leader of the Deer and *Persimmon Jim, the Possum, By Joseph Wharton Lippincott. Philadelphia. 1955. J. B. Lippincott Co. 128 and 125 pages. Illustrated by George F. Mason. $2.00 each.* New and revised editions of these good Nature stories for readers in the eight-to-eleven-year age group.

Sex and the Nature of Things. By N. J. Berrill. New York. 1955. Pocket Books. 22 pages. 35 cents. Paperbound edition of the original book reviewed earlier here.

Camp Counseling. By A. Viola Mitchell and Ida B. Crawford. Philadelphia. 1955. W. B. Saunders Co. 406 pages. Illustrated. A second and revised edition of this book for camp counsellors.

How the Animals Eat. By Millicent Selsam. New York. 1955. William R. Scott. 91 pages. Illustrated by Helen Ludwig. $2.50. A "Young Scott Book" on animal appetites from the ecological view but presented in simplest terms.

The Auto Camper's Guide to Canada. By George and Iris Wells. New York. 1955. Harper and Bros. 180 pages. $3.00. A handbook of auto camping and a motorists' guide to public camping grounds in Canada.

Our Natural Resources, Their Development and Use. Edited by Juanita Morris Kreps. New York. 1955. H. W. Wilson Co. 189 pages. $2.00. A rather deceptively titled book made up of selected writings on attitudes toward public lands, hydroelectric power, tidelands oil and atomic energy. Interesting reference work.

The Biology of the Amphibia. By G. Kingsley Noble. New York. 1955. Dover Publications. 577 pages. Illustrated. $4.95. An unabridged republication of this standard work on the natural history and biology of frogs, toads and salamanders.

Weeds. By W. C. Muenscher. New York. 1955. Macmillan. 560 pages. Illustrated. $10.00. A completely revised and reset edition of this standard work, with new material and new illustrations. Always valuable, it is now even more so.

The Facts of Life. By C. D. Darlington. New York. 1955. Macmillan. 467 pages. $7.00. A British author writes on sex, mating, heredity, race, class and evolution.

Seeds of Life. By John Langdon-Davies. New York. 1955. The Devin-Adair Co. 172 pages. $3.00. This is a popular discussion of sex in Nature, from amoeba to man.

Contents noted

BY THE EDITOR

FOR THE INFORMATION OF OUR MEMBERS, and in answer to inquiries, may we say that the American Nature Association—in common with the National Audubon Society, the Izaak Walton League of America, the National Wildlife Federation, the Wilderness Society, the Conservation Foundation, the American Forestry Association, the Conservation Education Association, and other national conservation organizations—is not a participant in the fund drive of the United Conservation Fund, Inc.

PUBLIC USE OF NATIONAL WILDLIFE REFUGES set a new record in 1954, thus underlining the steady increase in the recreational significance of these areas. There were 4,686,909 visitors to the refuges in 1954, about one-third of them for the purpose of fishing. Public hunting of waterfowl is permitted on thirty-two of the areas, and big game hunting and upland game shooting is allowed on twenty-three of the others. There were 361,366 visitor-days of use for hunting purposes. The balance of the visitor-days spent on the refuges, or more than half of their use, was for camping, boating, picnicking, photography, observation of wildlife and similar non-consumptive use. Of course, the major objective of the refuge system is to provide protection for birds and mammals, and this should always be the basic purpose. However, the policy of making the refuges available for other forms of public enjoyment that do not adversely affect the wildlife interests is excellent. This multiple significance of the Federal refuge system emphasizes the wisdom—and, indeed, the need—of H. R. 5306, introduced by Congressman Lee Metcalf and seeking to protect the refuges from all exploitation, whether private or public.

THE AMAZING INTEREST IN DAVY CROCKETT that Walt Disney has aroused has certain unfortunate results that Walt without doubt never anticipated. Indeed, we are certain that he must deplore them, knowing his deep concern for wildlife and its protection. However, the creation of an army of miniature Davy Crocketts has created a demand for coonskin hats such as Senator Kefauver never approached. Many of these headgear are advertised as genuine raccoon, which is no good thing for the population of these interesting mammals. And Davy's reliance on his trusty rifle, "Betsy," has found its counterpart in arming regiments of juvenile Crocketts with air rifles, with which they shoot at any bird or small mammal. While the markmanship of the small fry cannot equal the touted unerring aim of the hero of the Alamo, stories and pictures in the newspapers testify to an unfortunate amount of stalking in the image of the "king of the wild frontier."

THANKS TO THE AMERICAN FORESTRY ASSOCIATION there appears excellent prospect that something will be done to correct the serious abuses to our National Forests under the antiquated mining laws. Lowell Besley, executive director and forester of A. F. A., brought together representatives of the American Mining Congress and of the Departments of Agriculture and Interior. He was convinced that this serious problem could be solved by a meeting of the varied interests involved. From this conference have come several bills that strike at the improper or fraudulent claims now plaguing the Forest Service. While none of these may represent the ideal they do represent great progress toward the solution of a serious resource problem. Under the present laws it is possible to file mining claims on land in national forests and thus gain control of the timber, block access to areas, and turn the land claimed to other purposes that seriously interfere with administration by the U. S. Forest Service.

A THOROUGH STUDY OF NATIONAL PARKS and National Monuments is urged in a resolution adopted by the Executive Committee of the American Automobile Association. This is proposed in the conviction that there is need to "review and evaluate the entire role of the national parks, and measure the long range effect of the present policy of drift from the original park concept." The resolution cites the tremendous growth in use of the parks in contrast to the actual decline in personnel and facilities available. The A.A.A. does not believe that money is the simple solution that many suggest. Citing the original aim of the parks, the resolution points out that there are "powerful proposals aimed at modifying this aim and for using the park lands for far different purposes. In some areas recreational developments already bear commercial aspects not in keeping with the surroundings." There is much to be said for this proposal because these modifying influences have been gradual, individually seeming minor but in the aggregate being extremely dangerous. A competent, well-rounded and objective study such as is proposed could well serve to reaffirm the original concept of the National Park System and reverse present trends.

R.W.W.

Along lush, sedge-grown borders of the cattail-tule marsh, lake-margin diving ducks rear downy young like this ring-necked duckling.

Along the margins of the marsh one reads

Cattail and Tule Tales

By JOHN LINDSEY BLACKFORD

Photographs by the author

THE SHARP bow of the boat eagerly divided tall tules belting a steep, lodgepole-lined stretch of shore. The craft glided to a low-lying windfall slanting down from a needle-padded forest trail in northwestern Montana. The Old Bird Man came aboard. His experienced step amidships and seating forward scarcely interrupted the easy wind-rock of the buoyant, square-stern canoe. His knowing weather-eye squinted critically at the glittering expanse of Island Lake before us. Clear of the sedges, I snappily jerked the cord and the outboard was off to an enthusiastic and rather vociferous start.

Wading out into mirrored waters where lily pads float, graceful tules lend unexpected beauty to marshy margins of Island Lake.

Now the sun beat hotly on scummy marsh and wide, warm, amber-stained lake waters. I spun the motor out into the narrows along my "chartered" course through the waterweeds. Yet sadly, before reaching mid-channel, the outboard struggled, sputtered, coughed and "konked out."

"I thought I'd found an open lane through that stuff," I explained sheepishly to my companion, while heaving the triple-bladed propeller to the surface and leaning far back to clear it of tightly wound coontail and crowfoot.

"You likely did last night," he grinned. "But you know these pondweeds rise to the surface toward midday, come a bright, sunny day like this. Especially liable to

now when they're in bloom. But they'll mostly sink again toward evening. That's how you ran in clear last night." And he added reflectively, "they sink on cloudy days too."

I absorbed his remarks like a blotter; scrutinized with more attentive eyes the near-surface mat of aquatics; noted the streaming leaves of pondweed and the thickly scattered, white flower-array of the blossoming crowfoot. Secretly delighted, I throttled back half a dozen questions. The Old Bird Man was in a communicative mood.

That surmise was verified as the boat drove past the Island, kicking white water into a high stern-wave. A pair of white-bellied tree swallows burst from ancient woodpecker nest-holes honeycombing the huge fir stub that leaned steeply over the water at the point of the wooded isle. "In spring returned swallows play about the big nest stub on the Island like bees about a hive," volunteered the old-timer. "Let's go ashore. The loons could still be nesting, though more likely they've brought off their young."

We grounded on fine gravel, lifted out the camera pack and drew in the canoe. Each followed one steep bank. Nearly to the far point, I called: "Too late. Come look." Completing the circuit on his side the Old Bird Man joined me. At our feet a shallow, empty shelf at water's edge, its damp grasses worn and matted, told the story.

Returning around the point to face the widest reach of the lake, we swept its sparkling waters with the glasses. Bobbing in distant sun-glitter, two tiny dark specks were seen skillfully riding between a pair of low-hulled, swiftly streamlined, torpedo-like divers—the downy loonlets escorted by their submersible parents.

Cupping hands, my friend sent an eerie imitation of a loon's wailing laughter quavering out over the lake. *Oh-ah-oo-ooooo.* But the convoy preferred to remain unheard.

With the outboard silent, we drifted on along the nearer cattail coast. Presently the Old Bird Man held up a signaling hand and pointed to a curiously reed-woven, three-story, overwater nest laced to lakeside leaf-stalks just ahead. "Easy to tell who done it," he informed. "Hear that watch-winding scold of the marsh wren?"

By parting broad, succulent blades with the paddle, or shoving into half-hidden back-water channels in the floating sedge-mat, we found several single-apartment huts. All were tightly lashed to crowding cattails and tules above high-water mark. Dead, water-soaked leaf

Heaving waves of wilderness waters will be the adventurous home of this young loon. But until he can dive superbly, the old birds will keep him close to the sheltering shore-line marshes.

stems of last year's growth had been cleverly interwoven in constructing the coconut-shaped abodes. Since drying, they appeared rain proof. "An occupied brood nest can be told from these 'dummy' and shelter nests because it's much more heavily lined with cattail down," commented my fellow bird explorer.

Only an occasional mouse-like glimpse of his stub-tailed person was allowed us by the fidgety midget who claimed this watery jungle. But his rachety scolding sputtered all about as the abbreviated imp slipped close through the lush tule stems.

The reed wren refused to identify his guarded home locality, so we pushed on through the miry morass. Now disheveled saw-grass tussocks hummocked the bog. Fairy paddle greened weedy pools. Black, clutching ooze sucked at the slick craft. A not unpleasant stench of stagnant back water and rotting marsh growth carried heavily along with us.

Soon a more exciting, unidentified rustling in rank sword-leaves of a winding fenway warmed up the Old Bird Man: "Take like over at Kila Marsh. You find the soras place their nests there under heavy lodging of old slough grass blades. Most often I've found phalaropes nesting at the end of May. They'd be in marshy swales over a couple inches of water in the reed grasses."

The canoe glided on into open lake waters beneath a timbered ridge. A black-white arrow shot flashing from pole-like evergreens across the deep bay to an opposite crest. "In this country Clark's nutcracker nests fifteen to thirty feet up in the lodgepoles in April. That's so even where the jackpines are s' high you have t' look twice t'see the tops of 'em.

"Over in the Valley vesper sparrows keep to the grassy glacial ridges. If you want goldfinch pictures, wait till ripening of the bull thistle down. Their nests are mostly made of it."

After lunch, sitting astride a weathered shore log, he pulled a stubby pipe from the corner of his mouth and listened intently. On that sunny mid-June afternoon a yelping chorus suddenly broke into our conversation from the ridgetop above. "Don't know what's in it," he exclaimed, examining the cloudless sky, "but they al'wys say that coyotes howlin' in the daytime foretells rain."

Where the wooded hills swung back to admit a shallow shore, we cruised again beside the verdant cattail-tule wall. In one marsh-bounded cove a golden yellow-throat, like a darting sunbeam, pursued insects in dizzy circles above glistening lily pads. Abruptly, as if released from a bent bow, the flashing warbler arrowed out a hundred yards over the glaring lake surface after a ruby damsel fly.

While shadows drew on at evening we watched a mother golden-eye and her duckling brood put out toward the opposite shore. At first the beady-eyed youngsters rafted close behind and paddled obediently in her wake. Soon they made little leaping dives. The glasses told that often all would surface close together, although they gathered from several directions. What

Several single-apartment huts of the marsh wren were tightly lashed to cattails and tules.

In spring returned swallows play about the big nest stub like bees about a hive.

underwater signal brought them to that single rendezvous? On occasion the duck would fly ahead. And promptly the fuzzy fleet maneuvered into line and followed.

Passing over offshore shallows marked by thin, deep-wading tules, the whole company skittered prettily away from a lance-billed grebe. She guarded a low-floating nest-platform anchored in the reeds. A second alert female whistler joined in escort of the family. We noted how their course was rapidly converging upon that of another aquatic traveler. Some furry head was fast approaching from the farther marshes, raising a steady bow-ripple in the now mirrored and oily waters at the point of his V-like wake.

The golden-eye fleet indifferently hove to, and the ducklings resumed their surface dabbling. The swimming beaver not only passed to leeward at a couple duck-lengths, but, as curious as ourselves, deserted his compass-straight course, and at no greater distance circled the entire flotilla. Without other incident, or even a a tail-slap to take notice of us, he glided silently on into a cattail cove.

"I've never had the luck to locate a tree-duck's nest hereabouts," the Old Bird Man called back from up forward, as the propeller boiled up a white, foaming trail and the boat then smoothly sought its distant landing. "But I can tell you how to find it.

"The old duck comes flying through the woods like a bullet to the nest tree. Often it's some dead stub or fire-killed snag where a pileated woodpecker has left a ready-made house for her. Even then the nest hole seems too small for any duck. But the old golden-eye circles her tree three times. Then she goes in like a shot. I've observed this with several pairs. It was always done that way."

Returned to its morning landing, the boat slipped in again through clutching waterweeds to the shore. My companion skillfully ascended the swaying windfall to the pine-clad bank and silently disappeared down the lodgepole trail.

Leaving him to find his cabin in oncoming dusk, the canoe cruised out past a wooded point, across the lake, and into a wide, curving bay.

Camped there alone under the pines at sundown, I watched a dying afterglow. Flecked by pale rose and ashen cloudlets, the crimson sky light faded. A last flare of salmon-pink dissolved into violet-gray. Quickly the enclosing forest darkened about the mirrored lake.

Ooh-ah-eee-ooooo..... *Eeee-ah-ooooo*..... The wild wailing rose, then fell. Intervening silences seemed to quiver interminably. At once a weird loneliness and a haunting inspiration descended upon the dimming scene. As the loon-cry lifted again, I shivered; yet thrilled immeasurably with delight. Veritably it was the supreme voicing of all that the Wilderness holds, like a call from the Unknown, the Eternal. *Ooh-eeeee-ooooo*..... *Ooo-woooo-ooo*..... *Eeee-ah-ooooo*..... It clutched at the heart.

From a gaunt tamarack spire wide wings swooped down to the black water. It was too dim to be sure, so I reached for the binoculars. In their magic, luminous circle an osprey lightly skimmed the surface, his taloned feet just cutting the still water. Then he banked away on magnificent pinions, white body-plumage gleaming.

Again the fish hawk glided down to the dark lake, coming in so low there was no suggestion of stoop or plunge. His winging form raced level over it. Extended talons ripped the surface for as far as a skittering coot might take to climb a-wing. Twice more the fish eagle wheeled and skimmed the placid waters, only clawed feet beneath. At length he mounted, swung away to the swampy over-flow channel where it divided the black, foreboding forest, and vanished toward the Valley.

Ospreys were not frequent here. But elsewhere, several times, I had seen this same maneuver at evening. Over the campfire coals, I pondered. What finny prey might a fishhawk take in skimming, sundown flights? Once, when another such fisherman returned to his skyline perch, his claws had held none. Nor had I ever seen a catch thus curiously made. Why at nightfall did an osprey, without striking, swoop repeatedly to dip his talons in the water?

Perhaps it had been there waiting. Now I thought I saw the answer. Could the osprey, which feeds upon fresh fish—commonly easy-to-take "trash" varieties, but in any case flesh that deteriorates rapidly into poisonous decay—be cleaning his hooked fishing gear? Was this another of those sagacious, strangely instinctive habits such as wild things display in living their marvelously adjusted natural lives?

It has been considered a sanitary act when vultures rest for long upon their perches with wide wings extended to the sterilizing sun. I think it reasonable then that the fish hawk's talons, which pierce its prey and carry food to its young, must have their routine cleansing.

A night wind softly stirred the close-ranked pines. Embers of the fire brightened; a flame flared up. Somewhere along the shore an aquatic diver broke the silence with a watery splash. The flame wavered, flickered, faded out.

Poking my feet into a sleeping bag in the velvety dark, the Old Bird Man's parting warning again overcame me:

"Now you're headin' on into the hills tomorrow. Where you goin' t'get your water up in that country?" And without waiting for reply, "Yah, I know there's a whole lake-full of it there. But since they started trucking cattle into that country, there ain't nowheres fit to drink out of."

"I was thinking so too," I assured him. "Last time in there I asked the Old Miner about filling the canteen at his spring. He said go right ahead."

"You'd better stop back around the lake in the morning 'n use the pump at my cabin," admonished my elderly friend. "I've seen dead squirrels in that there spring of his." And, with a waggle of his snowy head and a gleam in his eye, "An' then he drinks out'n it himself."

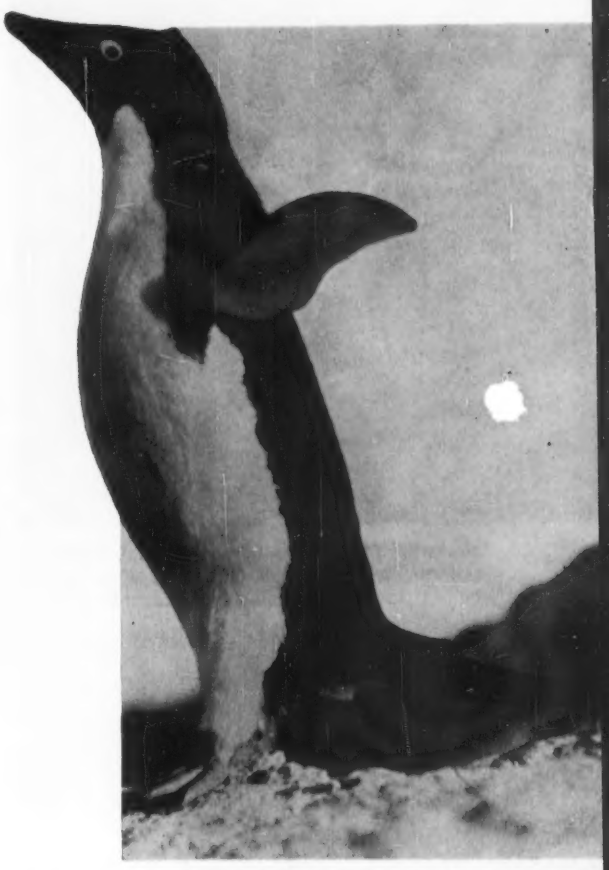
Birds at Play

By W. L. McATEE

Duck hawks welcome any test of their powers on the wing.

PLAY IN animals is usually defined as activity that is not directly useful. It is commonly displayed by young mammals in doings that appear to be preludes to adult behavior. Yet in birds it is seen mostly among adults, for the reason, apparently, that among birds, in general, the immature stage is relatively short. From the time of their first full feathering, most birds live independently of their parents and scarcely have an adolescent period characterized by non-utilitarian activities. Nevertheless, birds play, instances being known throughout the group. From penguins, ranked as primitive, to weaver-birds, considered advanced in the evolutionary scale, birds sometimes act in ways that may fairly be regarded as play.

In an account of the Adelie penguin of South Victoria Land, Murray Levick described communal diving in which the succession of birds plunging into the water was so rapid as to suggest the pouring of shot from a bottle. Another play of these penguins was to board an ice floe for a ride down a tide current to the end of their rookery. There they jumped off and swam back against the stream to catch another floe and repeat the ride. This seems analogous to the downhill coasting of young humans.



Penguins, although rated low on the evolutionary scale, have been observed at play.

Wary, intelligent, curious, imitative and mischievous, crows have qualifications for play.

Trahair Hartley, writing of the European little grebes, says that in early spring they "indulge in antics which seem to be quite spontaneous and literally playful. Small parties . . . race to and fro, spattering over the surface, or make simultaneous dives, throwing up big splashes of water. There is a good deal of calling while these games are in progress."

Snake-birds, so named from their long, sinuous necks, of which we have an American species, the anhinga, have been observed playing catch with a stick, in which great dexterity of neck and bill were demonstrated.

In several European countries, the white stork is a familiar bird, nesting on house-tops, chimneys, and other elevated sites. Individuals have been tamed and one of these was reported by Groos, in his work on *The Play of Animals*, to join children in games of tag, catching their coats or sleeves with its bill, then running

Storks have been seen playing games of tag with children, catching coats or sleeves with the bill and then running to be caught.

Chickadees appear to have a sense of humor and to indulge in play.

Cedar waxwings have been observed passing a berry from one to another, which may be an example of play or may serve a useful purpose.

away, but looking back to see if it was followed and even extending a wing to be caught.

What sometimes seems to be play of wild ducks is so like their courting as to make one uncertain whether to call it play, but surely their repeated "shooting" of rapids is something done just for fun. This has been observed in mallard, goldeneye, and eider, ducks.

So expert are the hawks at flying that it may be difficult to tell when their aerial acrobatics are part of their every-day life and when they are for sport. But the young of various species have been seen toying, as do kittens, with mock prey, and an eagle was noted taking a turf from a stack in Ireland, rising with it, dropping it, and catching it again in the air. That, at least, would seem to comply with the non-utilitarian concept of bird play.

Hawks frequently make passes at other birds, including their own kind, evidently without intention to strike them. Herbert L. Stoddard and I saw a duck hawk in northwest Florida, flying above a little blue heron, apparently "tickling" the heron's back with its talons but not attempting to use them more forcibly, although the heron's frightened manner showed that it did not rely on the hawk's temporary lack of ferocity. Duck hawks are so skillful a-wing that they seem to welcome any unusual test of their powers. In Washington, D. C., where birds of this species sometimes wintered about the old Postoffice Department building, during a gale when the air was filled with dust and debris, I saw one of these hawks diving and scaling through the storm in every direction, apparently just to enjoy its mastery of the winds. And what a sight to see among tall buildings in the heart of the Nation's capital!

Cranes, in zoological gardens, sometimes indulge in wild dancing, which may be set off by band music or other loud sound, and is accompanied by their own raucous cries. Such birds have also been noted to throw objects in the air and catch them with their bills. Both of these forms of play I have witnessed in the Washington "Zoo." Perhaps captive birds, with time to "kill," resort to play more than do their fellows in the wild, who have a living to make.

The crested screamer, a loud-voiced bird, was observed by W. H. Hudson in Argentina to engage in curious communal shouting. In a dry time, when the birds had congregated about a small lake, the flocks took turns in strident chanting, the wave of sound going around the lake, each flock awaiting its proper turn to vociferate.

Bird play seems manifested most in skills the performers have to the fullest measure. Thus, with gulls, various examples are connected with their powers of flight. An English observer saw herring gulls attempting to ride a revolving chimney-cowl that spun rapidly with the wind. Only one bird at a time could perch on it, maintaining balance at low speeds of the cowl, but as the revolutions increased, despite much fluttering and squawking, being forced off. There was always another candidate for the slippery post, and the cries

of companions as well as of the actors seemed to indicate that the sport was enjoyed.

Caged parrots are often seen to indulge in mere pastimes, and wild ones are known to share the propensity. In Australia, galah cockatoos were observed by N. H. Pearse repeatedly to slide down a sloping guy wire to which they clung with their beaks. And in New Zealand the remarkable carnivorous kea parrots were noted rolling empty tin cans down a roof and coasting after them, themselves. Tool-using is hailed as a proof of intelligence and the action described would seem to be employment of a tool, if only to provide entertainment.

Once at the Milwaukee "Zoo," I chanced to be at the right place and time to see a game of catch between a man and a common hornbill; the "ball" was a California grape. Instead of swallowing it when caught, as one would expect, the bird worked it forward to the tip of its grotesque, but far from awkward, bill and held it there until the man took and tossed it again. That bird surely was playing and although its hard face prevented a smile, the hornbill probably enjoyed the sport as much as did its partner.

The crow family is popularly credited with wariness and intelligence, and in captivity its members display curiosity, imitation, and tendency toward mischief. Such traits qualify them for play, and it has been related of numerous corvine pets that they delighted in tweaking a sleeping dog or cat, then retreating rapidly by wing. Ravens, in the North, are reported to drop sticks and stones on reposing sledge dogs to awaken and startle them. Various birds of this family indulge in aerial gymnastics, apparently for pleasure, but it may be difficult to separate some of these doings from mating performances.

Reminding one of the gull play previously described is that of European jackdaws observed to crowd one another off the tip of a tall perch into a strong wind, against which the victim must battle to get back and later shove another daw off the precarious but coveted position. Both captive and wild crow allies have a propensity for collecting and hiding shiny objects. An entomologist, finding ornamental pebbles in large cocoons of a moth, learned that bluejays were putting them there. Chickadees, of another bird family, have been known to use similar caches for kernels of corn.

Swallows, so at home in the air, naturally play there, not only in special modes of flight, but in dropping and catching straws, feathers, and other light objects by single birds, but also in catch-as-catch-can by groups of their kind.

The pleasure of coasting seems to be appreciated by a variety of birds. Besides the penguins, ducks, and keas of earlier paragraphs, mountain chickadees were observed in such play by M. P. Skinner. The medium of their sport was the brim of a hat hanging on a tree trunk. As a bird alighted on the hat, it tipped and spilled him off. Others got the idea and repeatedly tried this new thrill for no (*continued on page 388*)

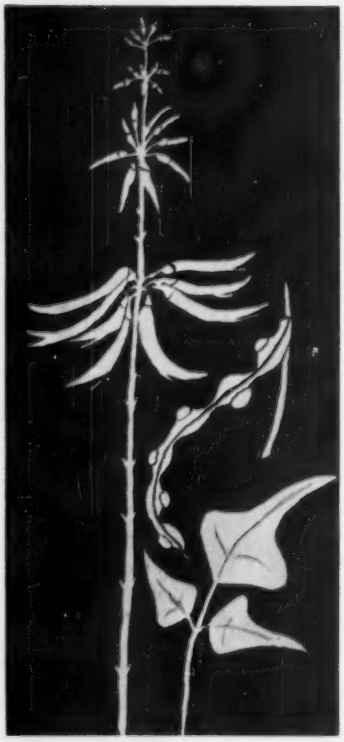
Gulls have been observed in many doings that appear to be examples of play. Most of these seem to be related to the birds' flight powers.

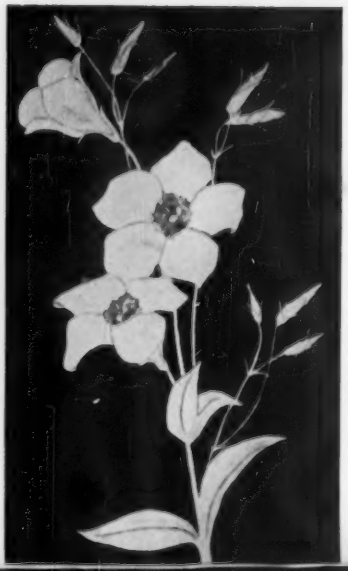
Snake-birds, or anhingas, have been seen playing catch with a stick.

Some courting antics of ducks may seem to be play, but some species have been seen shooting rapids for fun, definitely a playful gesture.

In the prairie States there are

Flower





WE WHO live in the prairie states are proud to call them "the breadbasket of the continent." We boast of the bread, meat, clothing and sweets we supply to a cold and hungry world. It may be because the central plains cover such a vast area that few seem to realize the danger that the natural prairies of the United States may follow the American bison to practical extinction.

As human populations increase it seems inevitable that many forms of wildlife must retreat—or surrender. Regions possessing outstanding scenic grandeur are more-or-less protected, or at least represented by our great national parks and forests. Some state parks are more devoted to outdoor sports than to wildlife preservation.

So far as our prairie flowers are concerned, they have extended their ranges through the usually unconscious assistance of human travel and shipping. Railroad right-of-ways are often the "natural" sanctuaries of a great variety of plant life. In Texas and a few other States the highway departments have led the way by recognizing the tourist-attraction values of roadsides lined with wild flowers. Overgrazing and plowing carried to the very fence-posts have often left these traffic borders as the last, slim havens of wildlife.

New England's trilliums, hepaticas and trailing arbutus have been praised in poetry and schoolbooks. They are often more familiar in name and fame to the children of the middle-West than their own dusty Cinderellas that shyly line the paths to prairie schoolhouses. Many are still waiting unheeded outside our gates, silently pleading for us to wield our magic wands, and bring them into the dazzling ballrooms of our gardens there to take rightful places beside their haughty step-sisters.

Of course, the best places to enjoy wild flowers are in their natural haunts, and more publicly-owned, natural wildflower sanctuaries are greatly needed. Yet there are many ignored species that deserve the safe although smaller sanctuaries of our home gardens. The qualities that these wildlings can contribute include delicacy, refinement, grace and often fragrance. Plant-breeders have usually increased the sizes of flowers, but this does not necessarily make them more beautiful. Indeed some flower lovers feel that in doubling or multiplying the number of petals much beauty of form has been lost. The greatest yardage of material may not produce the most becoming dress.

Since the wild flowers here described are not bog plants, and since most of them enjoy wide ranges, they can scarcely be classed as rare—*so far*. But several of them are definitely suffering from over-picking, in addition to the more "inevitable" destructive factors of human occupation. Besides their attractive qualities for gardens, we include those the blossoms or fruits of which are useful for indoor arrangements. Such familiar prairie na-

At the top, scarlet trumpets tilt out of the silvery waxed leaf-saucers of the cupleaf penstemon. Center, the coral bean is cherished as much for its scarlet beans as for its crimson flowers. Left, the prairie gentian, or "Texas bluebell," is the largest member of the aristocratic gentian family.

By NORMA STILLWELL

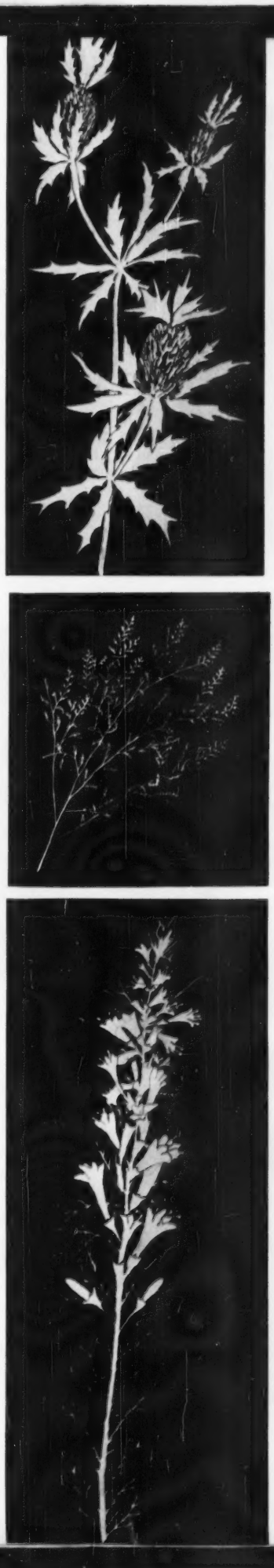
Silhouettes by Vera Rosevear and Primrose Jamieson; photographs by B. C. Tharp.

Cinderellas

tives as many of the phloxes, gaillardias, centaureas or basketflowers, Argemone or prickly-poppies, Lythrum or loosestrife, the many black-eyed Susans and Salvias or sages are not described here because they are listed in many catalogs and popular in gardens both East and West.

A lovely but neglected perennial species is *Penstemon murrayanus*. Its deep-scarlet, slender flower tubes are not much more than an inch long, several tilting out of each of the silvery waxed leaf saucers, which encircle the purplish stems an inch or so apart. It is a native of Arkansas and Texas. The published common name of "cutleaf penstemon" is obviously a misprint; cupleaf penstemon must have been intended. In our garden these natives of sandy woods have responded to our richer black loam and more sun to send their tapering spikes nearly six feet. New flowers continue to open along the everlengthening stems from early April through June. The slender, curving stems are most adaptable to artistic line arrangements.

From mid-May through June the flaming scarlet Texasplumes, *Gilia rubra*, of the phlox family, steal the spotlight in our garden. The color is only a trifle lighter than the red penstemon. The flaring tubes are slightly larger and densely crowded on the upright stalks, which are two to five feet tall. They reverse the common habit of flowering spikes by opening the topmost flowers first and blooming downward along the stem; botanists call this a "determinate inflorescence." The stems are thickly fringed with light green, threadlike leaves. This species is a bi-



At the top, thistle-like heads and spiny bracts of eryngo make attractive winter bouquets if cut soon after they turn purple in late summer. Center, slender *Dalea* might be used as an American babysbreath. Right, Texasplume, or standing cypress, sends flaming torches from the driest and rockiest kinds of soil.

ennial, growing wild from South Carolina to Arkansas, Florida and Texas, often in dry, open woods, or on rocky hillsides. The Texas Highway Department has found this one of the most adaptable and prolific of wild flowers. It can stand poor soil better than crowding from tall grasses, however. *Gilia aggregata* is a similar western species, not quite as tall and densely flowered, and with more pointed, drooping flower lobes. Both species have long been known as standing cypress, but an enthusiastic champion persuaded *Standardized Plant Names* to accept the Texas name. "Plume" for the flowers is better than "cypress" for the leaves. *Gilia longiflora*, with a westward range, has slender white flower tubes about two inches long. There are also some pretty, low-growing, blue-flowered species that deserve wider cultivation.

A third slender-spiked plant with even more striking red flowers than cupleaf penstemon and Texasplume, is the coralbean, *Erythrina herbacea*. It is native from North Carolina to Texas and the West Indies, and common along the Gulf Coast. Although the two-inch-long, red pea-flowers never spread their petals, the flowering spikes are unique and showy, of a tone nearer crimson than scarlet. When the long, dark, irregular pods open to reveal

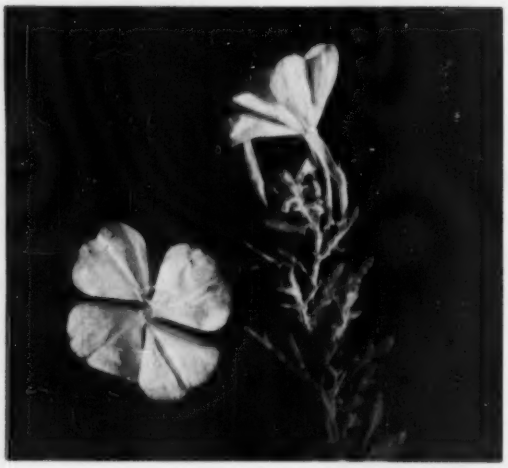
A yellow gaillardia, with a mahogany disk, blooms all summer.

their scarlet beans, the plant is even more striking. Since these beans cling to the open pods for years, when kept indoors, they are cherished for dried arrangements. The flowers, on the other hand, drop off almost at once if the stems are cut. I once made a pretty necklace of these glossy red beans, feeling a little like a murderer every time I forced the drill through a seed. Three or four years are required for the huge, carrot-shaped root to develop a plant of blooming size. It may be propagated more quickly from cuttings, although some growers believe the seed-grown plants are more hardy. The flowering spikes come up late in spring before the shoots bear the pretty, smooth leaves, and after one has begun to worry for fear the cherished plant is dead. Friends brought us a thick-rooted specimen from the coastal region. It bore twelve flowering stalks the second season after the transplanting and twenty-four the third; only to succumb to rootrot that summer! This root should be well protected in regions where the ground freezes much below the surface.

Purple eryngo, *Eryngium leavenworthii*, has dense, oval

The white evening primrose is too aggressive in gardens, but the slightly pink *Oenothera tetraptera* is very good.

The yellow day primrose is a slender, long-blooming little shrub.



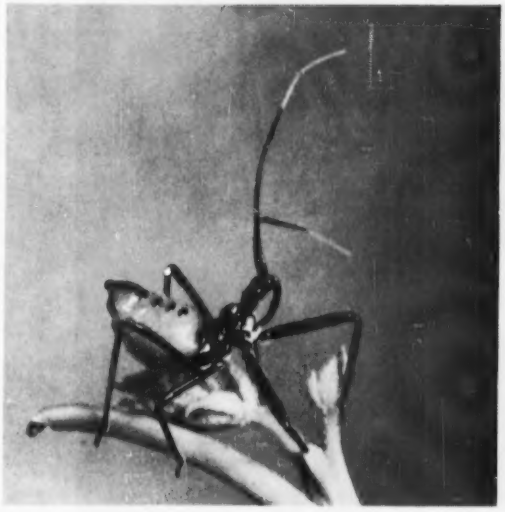
heads one to two inches long, and spiny, purplish bracts and upper leaves. It is sometimes called "blue thistle" as it does seem to resemble thistles more than it does the other members of its own family of carrots and Queen-Anne's-laces. This eryngo grows on dry, upland prairies from Kansas and Arkansas to Texas. If cut soon after it turns color, in late summer, it is quite lasting for winter bouquets.

There is a yellow gaillardia, *Gaillardia lanceolata*, which has light yellow rays but retains the mahogany disk of the more familiar scarlet varieties. I transplanted it from a nearby sandy region on May seventeen, while it was in bloom. In contrast to previous failure, the two little plants continued to bear flowers and ripen seeds all summer long and into October. This annual, or sometimes biennial species is a native of the southern States but might be tried far- (*continued on page 386*)

WHEEL BUG

By GEORGE A. SMITH

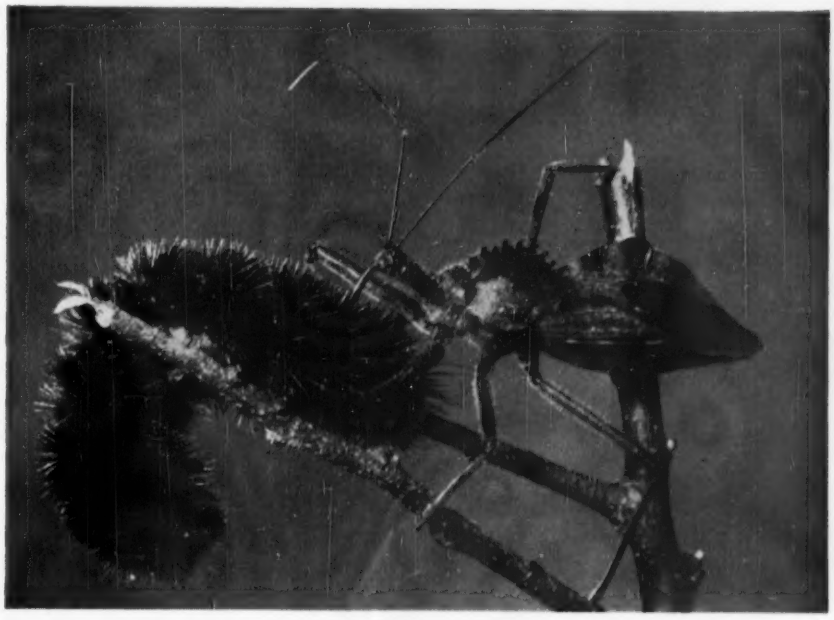
Photographs by the author



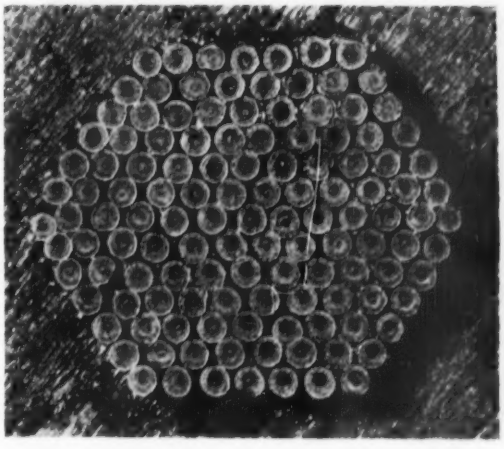
AN ODD-LOOKING insect, one of the numerous species of Assassin Bugs, is called the wheel bug. It is thus appropriately named because it has a semi-circular elevation on its back resembling a toothed wheel. Entomologists call it *Arilus cristatus*.

This insect is often found on low bushes during the warm summer months, usually basking quietly in the sunshine. It varies in length from less than one inch to about one inch and one-half.

The wheel bug is generally considered beneficial because it preys upon harmful insects, using its long, sharp beak effectively. It can nip you if it is handled carelessly. The insect is specially fond of caterpillars.



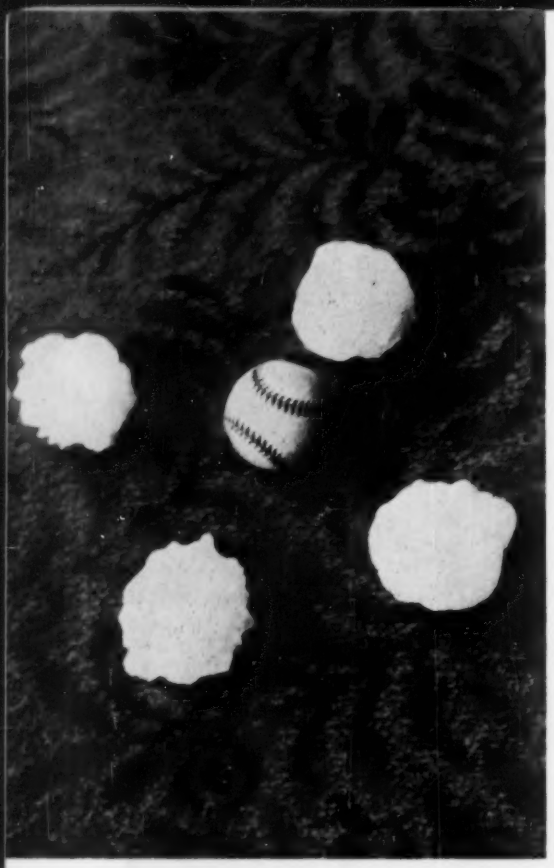
At the right is a wheel bug with a captured caterpillar. The wheel-like, or gear-like, formation from which this insect gets its common name is clearly seen here. Above is the nymph form of the wheel bug, which, in this stage, has a red body with black markings. Below are the geometrically arranged eggs of the wheel bug, looking like miniature black bottles with white stoppers.



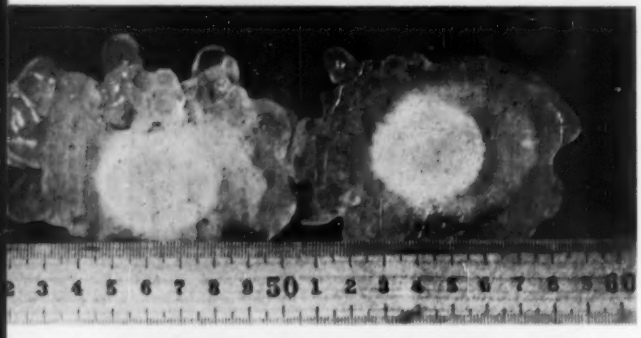
The eggs of the wheel bug look like miniature black bottles with fancy white-colored stoppers. They are generally cemented in clusters of fifty or more to the bark of trees and bushes in a six-sided design. The eggs are deposited in the fall and hatch during the next summer.

The nymphs free themselves from their eggs by pushing off the white-colored stoppers. When they first appear they are sprightly little fellows with red bodies and black markings, suggesting the present male vogue of wearing bright-colored vests with fancy buttons. As the young insects molt and increase in size they take on the grayish-black, slightly bronze color of the adult.

We Are Learning about HAIL



Hail "as big as baseballs" is an often-heard simile. Here are some that were.



Cut-away view of a large hailstone that fell in the Washington, D. C. area on May 26, 1953. It measured four inches in diameter.

It was not a whole lot of corn, but it was enough for what I had in mind as a boy. It was my own "patch," as the term is used in the South to denote that which is your very own. You took a youthful pleasure in looking at the lovely, sturdy stalks and green leaves. Then, one summer afternoon, it happened.

An ominous thundercloud massed up; soon we were in a regular thunderstorm. Then came a fury of hail. In five minutes my patch of corn was destroyed—a minor boyhood tragedy that has stayed in my memory all my life.

For a long time what a neighbor—a wind-burned, sun-tanned, and horny-palmed veteran farmer—had to say of that hail seemed cruel, but now I know better. "That's how it is with hail," he said.

Those pelting slugs of ice, dropping out of angry, swirling clouds, are usually accompanied by an express-train wind. The icy missles assail our cars, windows, houses, animals, and growing crops. It is no accident that descriptions of the furious rifle fire of the Civil War battles of the Wilderness, stripping trees bare and knocking down everything in the way, have been compared to hail.

Next to snow, hail is probably the most familiar kind of frozen precipitation. Actually, a hailstone has a certain kind of beauty if you will examine one closely. You will discover that a true hailstone is composed of layers of snow and ice, not unlike the structure of an onion.

There has been lively controversy about how hail originates W. J. Humphrey in his standard work, *The Physics of the Air*, explains, "Such drops of rain as the strong updraft within the thundercloud blows into the regions of freezing temperatures quickly congeal and also gather coatings of snow and ice." Some authorities say that the raindrop-hailstone is tossed up, again and again, in the updraft until finally the object gets so heavy it must fall.

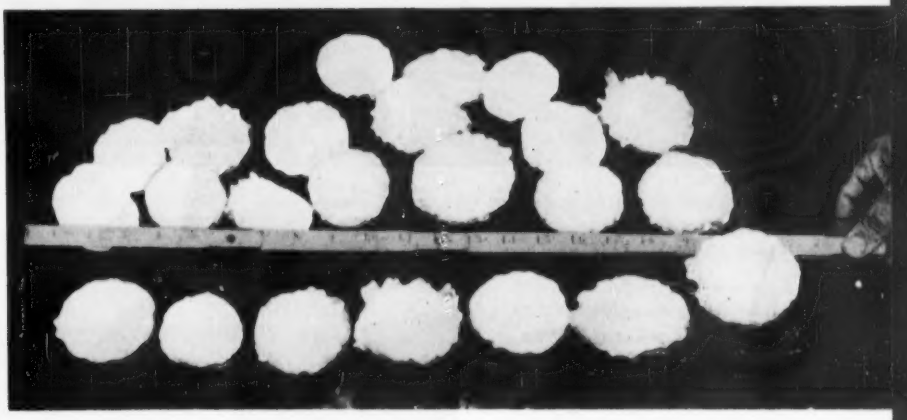
My eighty-year-old grandfather used to tell me of seeing hailstones the size of hen eggs in west Tennessee. Grandmother grew up in Indiana, and she told of hailstones the size of baseballs. Grandfather had an ambition to scoop up a dishpan full of hailstones so as to have the freezing element for home-made ice cream, but, for one reason or another, never fulfilled this ambition. Grandmother probably was correct when she said, "Hail is not that convenient."

Speaking of size of hailstones, the whoppers that fell out of the thunderstorm over Potter, Nebraska, on July 6, 1928, were large enough to serve as ice cubes for Paul Bunyan. According to official records, some Potter hailstones were seventeen inches in circumference, and weighed in at one and one-half pounds.

In one of his books about the weather, the late Charles Fitzhugh Talman, formerly of the United States Weather Bureau, had some interesting things to say about hail as a factor in the history of the world. For example, Mr. Talman explains that the devastating hail storm of 1788 ruined many a poor farmer in France, thus adding to the popular discontent that soon came to a head in

Potato-size was this hailstone that fell in a heavy hailstorm at Weatherford, Oklahoma, on July 1, 1940.

A heavy hailstorm hit Washington, D. C., on May 26, 1953. Below is a group of large hailstones collected immediately after this storm.



By JESSE C. BURT

Photographs from the U. S. Weather Bureau

the bloody French Revolution of 1789.

In other parts of the world, hail has been a deadly scourge. Hail rattled down on Cazorla, Spain, June 15, 1829, and crushed scores and scores of houses. The Spanish hail weighed four and one-half pounds per stone. At Bhor, India, October 5, 1893, 800 head of cattle were killed when hail covered the ground at a depth of from four to six feet. In this Indian storm, the hailstones were driven with such force that they bored clean, round holes in window glass, neatly drilled through tile, and buried themselves half-a-yard deep in the meadows.

One finds a good many reports of loss of human lives in these savage Indian hail storms. However, authorities point out that exposure to the elements probably causes death. So far as can be learned, apparently we do not have accredited reports of loss of human life in an American hail storm. However, being caught out in a hail storm is a somewhat unsatisfactory way of getting a massage.

Not very long ago two crew-cut and hatless teen-aged boys had just such an experience. After the hail was all over, one of the boys rubbed his head and grinned ruefully. "Say, man," he exclaimed. "You feel that hail? Felt like somebody was working my head over with a baseball bat. Man!"

The incredulity of the teen-ager only brought out the truth of what S. D. Flora, U. S. Weather Bureau, has said: "A violent hail storm has to be experienced personally to be believed."

Some years ago, Professor W. G. Brown of the University of Missouri told of experiencing a rather odd hail storm. He wrote: "On coming in contact with the windows or walls or pavements, the hailstones exploded with a loud report, so loud as to be mistaken for breaking window panes or a pistol shot. As the hail fell the fragments sprang up from the ground and flew in all directions, looking like a mass of popping corn on a large scale."

A destructive hail storm took place near Warsaw, Missouri, in June, 1931, and was described by a correspondent of the *Kansas City Star*, who wrote:

"There is a scene of destruction seven miles long and from a mile to a mile and a half wide in the Ozark farming community of Passo. Stones as large as baseballs stripped houses of weatherboarding, killed poultry, live stock, and piled-up four feet deep."

According to the correspondent, one farmer was asleep when the wind and hail came roaring across his place. His front door was knocked off the hinges; big hailstones came rattling and rolling inside. It proved impossible for him to hold a blanket up at the

Here is graphic evidence of the reason why automobile hail insurance is a good investment. This car was the victim of an Oklahoma hailstorm in 1940.

What hail can do to a field of cotton. In the icy downpour all the leaves were stripped from the cotton plants.

door, the hail was coming with such velocity.

"The following day hail was still being shoveled out of houses and barns, while cultivated fields looked as if they had been the playground of a giant with a shovel," the *Kansas City Star* concluded.

The Yearbook of Agriculture entitled *Climate and Man*, published by the U. S. Department of Agriculture says: "Damage to corn from hail occurs somewhere every year, although the annual losses in the national crop are not large. In local areas, however, loss is occasionally complete." The same may be said as readily about wheat, fruit, oats, barley, sugar beets, tobacco, and cotton.

Richard J. Roth, of the Crop-Hail Insurance Actuarial Association, has recently made a careful study of hail damage to growing crops. He says that, in general, vine crops, tree fruits, and lettuce are most affected by hail, while wheat, corn, and cotton are much less so. Tobacco is between the two extremes.

With corn, hail can shred the leaves, causing loss of part of the leaf tissue. In severe cases, the entire leaf blade is stripped from the midrib. If the hailstones are large, the stalks and ears may be bruised and broken, or even beaten to the ground. With tobacco, a few holes in the leaves of shade-grown leaf destroy its value for cigar wrappers. Tomatoes and vine crops are easily damaged by hail and are slow to recover.

Increase of knowledge of hail is encouraging. We now know that the mere size of hailstones is not necessarily the cause of severe economic loss. The "density" of hailstones—the numbers falling in a given area—is

What happens to a farmer's corn crop when a hail storm wipes it out in sad and dramatic fashion.

what counts. Thus the Potter, Nebraska, giants did comparatively little damage. Only one stone fell for about each one hundred square feet, says the scholarly *Monthly Weather Review* of the U. S. Weather Bureau.

We now know that the hail season may be thought of as occurring from May to September—although hail falls at other times. We also know that the highest hail-thunderstorm ratio in the country is found over the western Great Plains and the east slope of the Rocky Mountains, in a band extending from the Rio Grande River to the Canadian border.

Dr. John Ellickson, Bureau of Agricultural Economics, U. S. Department of Agriculture, says: "In the Great Plains the freezing level in the atmosphere is comparatively low so that there is frequent hail during the summer thunderstorms. Crops suffer more hail damage in the Great Plains than in any other section of the country."

Estimates of hail damage to crops over the whole nation go as high as $100,000,000, annually, at present price levels. *Agricultural Statistics* (U. S. D. A.) estimates that in the year 1952, most recent year available, farmers carried $1,572,000,000 in crop-hail insurance. They paid premiums that came to about $63,000,000. Losses covered by crop-hail insurance came to $34,000,000, which ought to suggest that there still is a big market for crop-hail insurance.

In round numbers, from 1934 to 1952, farmers the country over paid out a grand total of $550,000,000 for crop-hail insurance. Losses repaid in the same span of years were in excess of $300,000,000.

These striking data are dramatized in the following eye-witness description of a savage hail storm in Kansas: "Along the path of severest hail, wheat was a complete loss and the oats destroyed in some places. The grain was hammered into the ground until in some fields not a stem was left standing. Chickens, ducks, and geese, as well as birds, pigeons, and jack rabbits perished literally by the hundreds."

Hail insurance on growing crops dates from the year 1880. By 1946 it reached the billion dollar mark. Written by mutual companies, stock companies, and in a few instances by state hail insurance departments, crop-hail insurance has stood the test of time as the best practical protection for the farmer.

The rise of crop-hail insurance as a business has contributed in many ways to a more scientific understanding of hail, and to a more understanding grasp of what the farmer has to live with.

Also, one of the major problems in hail studies is to systematize data, and conduct observations of hail in action. Literally thousands of observers would be needed to get county-by-county data on hail storms.

The researches of the airline companies have been helpful, for they have a keen interest in hail. One airline report states that hail the size of walnuts or greater occurs in one out of eight-hundred thunderstorms near the airways between Colorado and Illinois. Much progress has been made in forecasting severe hail storms; and radar has been helpful in flight safety through "hail areas."

It has been argued that the thunderstorm, and its by-product of hail, may be "purely psychological." Few of the older airline captains hold to this view. A veteran United Air Lines captain commented on the "purely psychological" theory by looking back over his career and saying, "I never saw a *mild* thunderstorm between Dallas and Cleveland."

There is continuing discussion of "destroying" hail, in one way or another. There has been a rash of enthusiastic popular articles on how to do this. Interestingly, these trace right back into history. At one time, "hail rods," and "hail cannon," were widely prevalent in Europe. But hail still fell.

Awaiting the time when we have an even greater knowledge of hail, and how to farm better to meet its known destructiveness, the farmer's chief reliance is upon crop-hail insurance. Not too long ago a veteran farmer commented on the various plans to convert hail into either snow or ice. He was not impolite to these plans, but he remarked on the method of hail formation —rain lifted aloft again and again until it became heavy. His final comment to me was, "Well, I guess that what goes up sure has to come down."

While her country cousins established nests in grassy habitat on wind-swept dikes at Resthaven Sanctuary in northern Ohio, this hen mallard chose an old perambulator in a public dump.

A Maternal Mallard

By FLOYD B. CHAPMAN

EXTENDING from Toledo to Cleveland, along the Lake Erie shore, the northern Ohio marshes have been known for years among Ohio's duck hunters as the "cradle" of waterfowl production. This is far from being an accurate description, but one old hen mallard took the "cradle" legend seriously.

Resthaven is the Division of Wildlife's sanctuary, an old strip-mined area in Erie County, where marl has been removed for many years and used to manufacture Portland cement. Its more than 2000 acres is pretty much a no-man's land of dry marl ridges with water-holding depressions in between.

Waterfowl biologist Delmar Handley had trudged wearily over many acres of Resthaven's "obstacle course," one March morning, without finding a single new mallard nest. "Why not," he reasoned to himself, "work that old dump over by the dinky tracks?" After turning over an acre of tin cans, magazines, old furniture, wrecked auto bodies and other choice loot, Handley made a discovery. There, cozy as could be, under the top of an old perambulator, was a fluffy mallard's nest containing nine eggs. Biologist Handley squatted in the midst of the aromatic dump, scribbling down the date, number of eggs, kind of nest material and other vital statistics. Marking the location of the nest on his field map, he stood erect. Then the oddity of the situation struck him. Here was an old hen mallard who had chosen a most unorthodox place for her nest, where no self-respecting lady mallard ought to be. And yet, Handley mused, a baby carriage was a most appropriate spot.

The old hen was not around, but Handley affectionately dubbed her "Amy" and left. On his next visit Amy sat under her baby carriage, up to her ears in the downy breast feathers that lined the nest. Word got around about Amy and her unusual nursery, and soon scores of bird watchers and photographers visited Resthaven. For a week the dump crawled with people exploding flash bulbs and peering at Amy. Through all this she remained serene; never batted an eye. Her eggs were soon to hatch.

Early one morning Handley crept stealthily to the nest. Amy was gone and with her, somewhere in the marl pits of Resthaven, were nine fluffy yellow and brown ducklings. To her discoverer it seemed a pity that there had been no welcoming committee to cheer the little family into the world.

Underwater Pond Plants

By E. LAURENCE PALMER

Illustrated by Elizabeth Burkmyer

This is the eighty-second in NATURE MAGAZINE'S *series of educational inserts.*

Sago Pondweed

Bushy Naiad

Mud Plantain

THE subject of the special educational insert just before this one was cats. We tried to be neutral in our judgment of the merit of cats. While we received a number of letters supporting the view that cats might be undesirable members of a community, we also got the most vitriolic letter that this series has stimulated from a lady who resented a passing comment on a use of cats in zoological laboratories. We feel safe, this time, that we are writing about a subject that will elicit no such violent reaction. This is not to assume that underwater pond plants are not controversial. In some circles they are. In fact, their role in underwater economy has been almost completely reversed in the past two decades when we consider them as related to managed farm fish ponds.

This insert is a part of a series that has considered the story of the shallower fresh waters. Other units bearing on this subject that you may wish to consult are:

#1. Some Common Fresh-water Insects. #14. Marshes and Their Environs. #38. Sea Weeds. #56. Pond Surface Plants. #59. Mollusks of Land and Fresh Waters. #60. On the Level. #69. Fresh-water Algae. #70. More Water Insects. #79. Aquarium Fishes.

If you are interested in maintaining an aquarium, establishing a farm fish pond, managing a shallow body of fresh water, or just knowing about the plants that usually grow a few feet under the surface of any such shallow waterway, we hope that you will find this insert worth-while.

Basic in the appreciation of these plants is some understanding of how they may affect you and your neighbors. They may clog a swimming area, may influence the number of fishes available to fishermen, or the number of ducks available to sportsmen. They may affect the taste and safety of drinking water, the navigability of a canal or other body of water used in transport. They may affect the turbidity, alkalinity, temperature, odor, color and other characteristics of water. They may be associated with the number of mosquitoes in the neighborhood, and with the stench so often noticeable along shores. They may even affect the real estate value of property near a body of water that supports these plants. They may attract large wildlife species out of protective cover, may

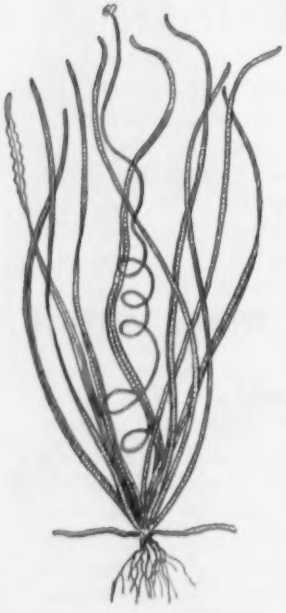
Hornwort

Water Milfoil

Elodea

create fatal hazards to swimming mammals, whether man or beast. They may affect water sports, or the loss of water by evaporation in areas where such loss may be critical to local economy and survival. They may add beauty to an aquarium, and, by increasing the oxygen content of the water, may reduce the labor attendant on the maintenance of an aquarium. They may provide a source of food to man and beast, and, in the past at least, may have yielded materials of direct economic importance. Thus it must be evident that these plants are not wholly inconsequential.

Sea Wrack



Wild Celery

As explained in the 39th insert, these plants support organisms that may have a profound effect on public health and have been important in maintaining an effective war potential in some foreign lands. There is little likelihood that they will be less important to man in the future than they have been in the past, or that they will fail to continue, in their own inexorable way, to influence important changes in the nature of the surface of the earth. Any well-informed person should have some appreciation of the role played by these organisms on a local or on a world-wide basis.

Much of the detailed information necessary for understanding these plants is provided in the chart section of this insert, or in the bibliography on page 385, but a sketchy review of the high points involved seems to be needed.

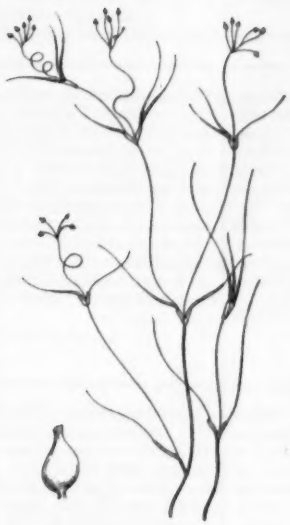
Let us define our group first. Essentially, we are dealing with those flowering plants that live in fresh or brackish water, and that may be submerged almost wholly for much of their lives. We have included one or two that may have floating or "emergent" parts, but for the most part these plants live and die beneath the surface of fresh water. Those that are conspicuous for their floating parts were considered in the 56th insert.

Ecologists agree that the nature of the surface of the earth is often changed effectively by the plants and animals that live on it. Commonly ponds and streams, over long periods of time, are recognized as being of a temporary nature. Streams, by cutting down and by building up deposits, change their whole nature. Some ponds and lakes become filled with sediments of many sorts and thus cease to be pools. The plants discussed here play an important role in this story. Many ecologists recognize about five stages in the evolution of a newly formed pool into a bit of forest land. In the first of these, the bottom of the pond is essentially free of conspicuous vegetation. In the second, submerged vegetation is dominant. Following this, there comes a stage in which the vegetation reaches the surface and extends above it, although surrounded by free water. Later, with the accumulation of sediments, the pond may be restricted in size and may even be merely temporary. Finally, the pond disappears and the surface is taken over by land forms. In this story, the plants in which we are now interested are dominant in the second stage and give way to competition in the third.

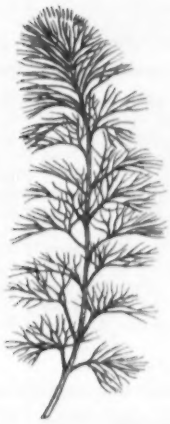
If the pond in which our plants grow has no outlet, obviously it will fill gradually with the accumulation of sediments without the plants doing much about it. However, if the pond is merely a part of a river, or if there is an outlet, the plants speed up the filling process by anchoring sediments that may be suspended in the water. Many of these plants are

Horned Pondweed

Arrowhead



Mermaid Weed

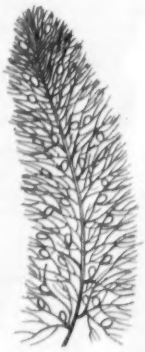


Cabomba

Curly Pondweed

Widgeon Grass

Water Fennel



Bladderwort

covered with a jelly-like coating to which the sediments cling.

Through the year there is usually less violent change of temperature and of light in a pond than there is on open ground. In other words, it rarely reaches the extremes of cold and heat that is found on dry land. Possibly because of this, the plants are not forced to survive by seeds that can normally survive difficult conditions. Anyway, our pond plants are mostly perennials, many of which continue growth through the year, while others go through the difficult season with the help of buried tubers, rootstocks and other vegetative parts. There is, however, a seasonal cycle caused by changes in temperature, and to some extent caused by the cutting off of light by snow-covered ice. In some ponds the decay of plants during this period so exhausts the oxygen from the water that many fishes are killed. This may be a factor in the relative success of farm fish ponds in both the North and South.

Most of our pond plants have weak stems. When they are taken from the water, they cannot remain erect. This weakness, however, is in a way a strength. Were they stiff they could not resist so easily the movement of the water that surrounds them. When wind blows over the surface of a pond, it may set up currents of water beneath the surface. Plants that can respond to this movement of the water may well survive. Plants growing on the mud bottoms of ponds may, like those growing on the ground, seek the light. This means that if they have devices filled with air that will lift parts of the plants towards the surface, it will be helpful. Many of our water plants have these devices and if crushed under water may be seen to free the air. Mucilaginous coating of the underwater parts may help to hold this air within the plants. Such surfaces are found on many of the plants we consider here. This air may be of value, also, to some animals that live much of their lives under water.

The light problem is important in what happens to ponds, and to our plants that are growing in them. The depth to which light penetrates is determined largely by the clearness of the water. Silt held in suspension may easily reduce the depth to which adequate light for plant growth will penetrate. If we need the plants, we might want the light to penetrate deeply. If we wanted to destroy the plants, we might do this by cutting off the light in some way. Modern fish pond management calls for doing just that. However, instead of cutting off the light by increasing the silt in suspension, this is done by increasing the minute plants and animals that may live near the surface of the water. This is done by increasing the food available to them and often this is supplied by the use of artificial fertilizers. The minute plants and animals that make up this "plankton" area are preyed upon by smaller animals that live beneath them. These, in turn, are preyed upon by the larger animals such as fishes that we may wish the pond to produce.

In managing fish ponds, it is usually the practice to prevent the plants featured in this insert from growing, but where we cannot add artificial food to normal ponds the plants may be useful. They (*continued on page 368*)

COMMON NAME SCIENTIFIC NAME	GRASS WRACK. SEA WRACK. EEL GRASS *Zostera marina*	SAGO PONDWEED *Potamogeton pectinatus*	CURLY PONDWEED *Potamogeton crispus*	CLASPING-LEAVED PONDWEED *Potamogeton perfoliatus*
DESCRIPTION	Stems, weak, branched, to 55 feet long, with thick rootstocks. Leaves, ribbon-like to 6 feet long and to 1/3 inch wide, with 3-7 principal nerves, with unnotched margins. Stem is sheathed by leaf bases. Leaves, blunt at the free end and in general appear coarser than those of *Vallisneria*.	Stems, to more than 20 feet long, heavily branched, being repeatedly branched into 2 parts. Leaves, narrow and almost hair-like, but somewhat stiff, with sharp, rather stiff ends, with 1 main nerve and few cross nerves. Stipules fast to stems for ½ their length, to 1 inch long, with chaff-like margins, and sharp-tipped.	Stems flattened, branched. Leaves alternate and 2-ranked, making whole plant appear as a flattened plane at times, with crisped margins, to 4 inches long and ¾-inch wide, from 3 to 7 nerves, with stipules at the base that do not remain long on the plant.	Stems, branched, slender. Leaves all submerged, round to narrow, with minute teeth in margins near the tips, although this may be obscured, heart-shaped at base and surrounding the stem, margins wavy and with 11 to 21 nerves, membranous, to 3 inches long and 1 inch wide.
RANGE AND RELATIONSHIP	Order Najadales. Family Zosteraceae. Usually completely submerged in brackish water up to 25% that of normal sea water. In temperate regions on Atlantic or Pacific Coasts, the Pacific Coast form having leaves to ¾ inches wide and 10-13 nerves. Bays and inlets Greenland to Florida and Alaska to California.	Order Najadales. Family Zosteraceae. In water from 2 to 5 feet deep, or more, over muddy or sandy bottoms. Ranges from southern Alaska to Newfoundland and south into Mexico, with greatest abundance from central New York west to Nevada and southeastern British Columbia. Found also in Europe, Britain and Australia.	Order Najadales. Family Zosteraceae. Ranges from Massachusetts to Virginia along the coast and extending erratically west to the coast where it is found in California, also in Utah, Wyoming, Oklahoma and South Dakota. It is also found in Europe, and has been introduced in other parts of the world.	Order Najadales. Family Zosteraceae. In brackish or calcareous waters from Newfoundland to Alaska, and south to Florida and central California, except area including southwest California, Arizona, New Mexico, Nebraska, Missouri and southern Appalachian highlands.
REPRODUCTION	Reproduces by seeds or by division of rootstocks. Plants bear flowers in crowded structure, which is about 1 to 2½ inches long and bears 10 to 20 staminate and a similar number of pistillate structures. Seed is about ⅛-inch long and bears 20 ribs and is blunt at each end.	Flowers borne in loose spikes of 2 to 6 flowers, flower whorls at or just above water surface. Fruits are nutlets to 1/6-inch long with 2 obscure ridges and rounded on the back. Embryo in the seed is in a complete spiral, or sometimes incomplete. Flowering time is July and August.	Flowers are borne in spike each about ½-inch long that has a bristle-like appearance. Fruits have a slightly soft exterior, a face that is somewhat curved, with 3 keels on the back, the middle one of which is the longest. The rather persistent style about equals the rest of the fruit in length.	Flowers borne in 2 to 8 whorls, on spikes just above water, the spikes being to nearly 1 inch long and 1/3-inch thick. Fruits are to ⅛-inch long and 1/10-inch in diameter and appear to be broad. Normal propagation is by segments of the rootstocks, by seeds, and by cuttings.
ECOLOGY	Possibly most widespread seed plant in temperate brackish waters, being found in Europe as well as in America. One of most important sources of duck food, and when plants began to disappear in 1930 from Atlantic Coast waters the duck problem increased. A fungus is greatest enemy of Atlantic coast forms.	Can grow in water with salt content 44% that of sea water and remain healthy, and can withstand high degree of alkalinity. This species is possibly the most important duck food in western alkaline lakes, and is probably the most important duck food on the continent, equalling all other pondweeds combined.	Does rather well in waters more polluted than those that will support some other pondweeds. For this reason this species may be more abundant near cities than some others. Normally winter is survived by peculiar winter buds that form, but these have food value to waterfowl.	Best growth takes place in waters with concentrations about 12% that of average sea water, but may survive in waters of to 25% the concentration of sea water. This plant usually does best over mucks or sands, and will do well either in still or in moving water.
ECONOMY	Industries used dried plants for stuffing cushions and for soundproofing, but had to suspend operations with disappearance of plant. Introduction of Pacific Coast form that resists enemy attack may restore the plant to its important economic place. Known as barnacle-grass, turtle-grass, drew, widgeon-grass.	Excellent food for ducks, muskrats, deer, moose, beaver and shore birds. The tubers, seeds and rootstocks constitute the bulk of the food eaten, but other parts of the plant serve also. Rated by aquarists as of high value in raising oxygen content of water in aquarium. Tubers are high in starch content.	Not very important as a species of pondweed, but can grow where others cannot, and for this reason serves a rather unique function. The flowers appear in August and the fruits persist long after that month.	This ranks high among the pondweeds, having value as food for waterfowl. It is rather regularly planted in waterfowl management programs.

DITCH-GRASS. WIDGEON GRASS. *Ruppia maritima*	HORNED PONDWEED *Zannichellia palustris*	BUSHY NAIAD *Najas flexilis*	ARROWHEAD. DUCK POTATO *Sagittaria cuneata*	ELODEA, WATERWEED. DITCH MOSS *Elodea canadensis*
Stems branching, threadlike, to more than 3 feet long, often whitish, with irregular internodes. Leaves, threadlike, to 4 inches long, alternate, sheathing stems at base with free part of stipule shorter than sheathing portion, or absent. Leaves of related alkaline-tolerant *R. occidentalis*, to 1½ feet long, and plant larger.	Stems almost threadlike, branching abundantly, weak, arising from extensive creeping rootstocks. Leaves opposite rather than alternate as in *Potamogeton* and longer, narrower and less crowded than in *Najas*. Leaves to 3 inches long and with membranous sheathing stipules at base.	Stems, to 20 feet long, slender, brittle commonly branched. If growing in shallow water, plants may appear bushy. Leaves slender, opposite, to 1 inch long and 1/10-inch wide, curled, light translucent green, crowded in upper ends of stems, tapering at base. Roots, fibrous. Annual.	Height, to 16 inches or even more, with leaves arising in clusters from buried tubers. When submerged, the leaves may be slender but when they come above the water they produce arrowhead-shaped blades that are 8 or 9 inches long and nearly as broad on occasion. Leaves are variable in shape.	Length, to more than 3 feet, with short internodes. Stems weak, brittle. Leaves, in whorls of 3s or 4s or even 2s, to ½-inch long, with finely irregular margins, usually bright green and translucent, broadest at base, to 1/5-inch wide. Stems may grow without roots, or roots may form at joints.
Order Najadales. Family Zosteraceae. Does well in lagoons where salt concentration is high. Most alkali resistant of flowering plants. Can live in fresh waters as well as saline or alkaline. Widely distributed over northern hemisphere. British Columbia to southern California on West Coast.	Order Najadales. Family Zosteraceae. May do best in fresh spring water, but can survive salinity to 1/3 that of sea water. Found from Gulf of St. Lawrence to Yukon and south into Mexico. Relatively common anywhere in the United States in suitable habitats, particularly in waters over rich soils. Found in Old World.	Order Najadales. Family Najadaceae. Ponds, streams and other fresh waters throughout most of North America. Also found in Europe. Most abundant in Great Lakes area. Uncommon in Texas, Colorado, Utah, Nevada and to the south. Five species in eastern areas. Some found in brackish water but most inland.	Order Najadales. Family Alismataceae. This species ranges from Newfoundland to central British Columbia and south to California, Kansas, and north of the Ohio and east through Pennsylvania. This is commonly lower than the related *S. latifolia*, and it bears tubers that are smaller. About 40 species.	Order Najadales. Family Hydrocharitaceae, The Frogbits. Native of North America, where it is found from coast to coast from Gulf of St. Lawrence to southern British Columbia to central California, central Texas and South Carolina. Introduced into England in 1847 by Babington, it quickly became a pest but subsided.
Reproduced normally by seeds or vegetative parts. Seeds borne in straight or hooked fruits in clusters to more than 1 inch long. Flowers in long clusters that become coiled into loose spirals at maturity. Some variation in nature of fruits and of fruit-bearing structures. Artificial propagation by cutting requires that cuttings come in contact with the soil.	Fruits, borne in clusters of 2 to 6, in axils of leaves and under water. Both staminate and pistillate flowers are borne under water. Mature fruits show a distinct horn, are short stalked or stalkless and fruit is around 1/10-inch long. The appearance of the fruit is responsible for the common name "horned."	Fruits borne in axils of leaves, singly, papery walled and enclosing a single seed, which tapers at each end and has long persistent style attached to enclosing fruit. Common propagation by fracture of plants, with broken sections forming new plants. Cutting may be tied to small stones and planted.	Reproduction, vegetatively by means of submerged tubers. Corolla, to 1 inch broad. Pistils and stamens, in separate flowers. Fruiting heads are crowded with seedlike structures with thickened wings and small beak. Flowering time is from July through September, and fruit bodies persist later.	Pistillate flowers, on long slender stems that reach water surface, with sepals to 1/10-inch long. Staminate flower with sepals to 1/5-inch long. Pistillate plant commonly has leaves crowded at branch tips. Fruit, small, oblong, few-seeded. Books contain conflicting statements about reproductive nature.
Excellent food and shelter for fishes of many kinds. Ducks also feed on fruits and vegetative parts. This is important in waters too brackish to support other food plants that can survive only in fresh waters. However, without this plant and a few others, many brackish and alkaline waterways would be deserted.	Fruits and foliage are eaten readily by wildfowl. In brackish waters this may be important in waterfowl management. The plants are considered as fair sources of food for trout in farm fish ponds managed for the raising of trout. The trout, of course, feed on organisms that feed on *Zannichellia*. Is propagated rather easily.	Can grow in waters to 20 feet deep if pollution is not too great. Can survive loss of light better than most associated plants. Does best in water from 1 to 4 feet deep. May grow over mud, or, better, over sandy bottom. Some species like *N. marina* favor brackish waters. Some do well on tidal flats.	A rather important duck food according to early estimates, but it is now believed to be less significant. The tubers are valuable for ducks but are commonly buried too deeply in the mud to be available. May be eaten by muskrats The seeds may be eaten by a number of animals.	Found commonly in fresh waters rich in lime, usually in ponds and slow streams. One common name, choke pondweed, gives some concept of its behavior. When introduced into Europe, it multiplied in 5 years to a serious abundance only gradually to become extinct, rare or harmlessly abundant on its own.
Seeds of ditch grass are harvested in late summer and are planted in late fall. Seeds stored over winter may become too dry and may lose their vitality. Fall plantings may be harvested by migrating birds, and so spring plants may be favored where labor is not competitive with common farm practices.	Ducks known to feed on this plant are black duck, pintail, mallard, gadwall, redhead, ringneck, bluebill, shoveller, widgeon and greenwinged and bluewinged teals. Landscape designers working with ponds do not favor *Zannicellia* because it lacks beauty. It does best in waters under 3 feet deep.	Stems, fruits and foliage may be a favored food for ducks wild and domesticated, with *N flexilis* apparently most popular with mallards. Makes good food and excellent shelter for fish and for fish food such as insects and small fishes. One of the better duck forage food in managed areas.	Aquarists like to grow some species of *Sagittoria*, in part because they seem to contribute a high amount of oxygen to the water. When they get too abundant they may merely be pulled out.	Ducks feed on fruits and leaves. May supply quick food to domestic ducks. Also eaten by horses and cattle where it is available. Leaves are a popular subject for study in biology classes because of transparent nature, which permits easy observation of streaming in protoplasm under a microscope.

COMMON NAME SCIENTIFIC NAME	WILD CELERY, TAPE GRASS, EEL GRASS *Vallisneria americana*	MUD PLANTAIN. WATER STARGRASS *Heteranthera dubia*	HORNWORT. COONTAIL *Ceratophyllum demersum*	CABOMBA, CAROLINA WATER SHIELD *Cabomba caroliniona*
DESCRIPTION	Stems, horizontal and buried in mud, the runners producing tufts of narrow, thin, 5-nerved leaves, to 20 feet long and to ¾-inch wide with the marginal nerves inconspicuous. Leaves, like pale green ribbons borne in tufts at intervals along the stem. New buds may be delicious to ducks and to man.	Length, to more than 3 feet. Stems, branching, slender, flattened, rooting at the joints. Leaves, flat, grasslike, parallel-veined, may turn to color of dying grass and may appear to be silt-covered, possibly giving the common name of mud plantain to it. Leaf sheaths are thin.	Stems, weak, to more than 20 feet long, without roots of any kind at any time. Leaves, in whorls of 5 to 12, 2 to 3 times divided, with the segments stiffly rigid and toothed-margined, to ¾-inch long, brittle, conspicuously crowded at branch tips particularly late in the season. Early season plants upright.	Stems, branched, weak, slender, gelatine-covered, to several feet long. Leaves opposite or whorled, divided into fine sections and arranged fan-like. Upper leaves sometimes alternate, some with floating blades but mostly submerged. Leaf sections, narrowly oblong. Leaves, to 2 inches broad.
RANGE AND RELATIONSHIP	Order Najadales. Family Hydrocharitaceae. From Nova Scotia to the Dakotas, and south to Texas and Florida. The closely related *V. spiralis* is found in Europe, and the two were once considered possibly the same. There is still some confusion on their status as species.	Order Xyridales. Family Pontederiaceae. Found often in great abundance in shallow fresh water of lakes, slow rivers and ponds, usually where water is hard. Ranges through most of the United States, but most common in East and mid-West. Quebec to Oregon and south to Cuba and Mexico. May grow in wet mud.	Order Ranunculales. Family Ceratophyllaceae. Found in every State of the Union and throughout most of North America, except in extreme north and Cuba. Most abundant in eastern United States in ditches, shallow pools and sluggish streams. Known also in Europe. Two species with inconspicuous differences are known.	Order Ranunculales. Family Nymphaceae. Found in fresh water ponds and slow streams. East of line running from Michigan through Illinois, Missouri, Arkansas, Louisiana and Texas and north to New Hampshire and south to Florida. Commonly found in aquarium supply stores over the country.
REPRODUCTION	Staminate flowers borne submerged, but break off and float to surface. Pistillate flowers, on long stalk, which reaches to surface where pollination takes place. Following this, the fruit stalk contracts in a spiral, permitting maturity to take place under water. Fruit, to ½-inch long.	Flowers, relatively inconspicuous, borne singly at end of thread-like tube. Pale yellow, of 6 parts, with stamens longer than included pistil. Fruit, a one-celled, many-seeded capsule. More likely to flower when stranded in mud than in open water. Flowers from July through October.	Clusters of 8 to 20 staminate flowers, each consisting of a stamen, are surrounded by 10-12 bracts that are forked; are found in whorls. Anthers float to surface, free pollen, which sinks to submerged pistillate flowers, which are borne at stem joints. Fruit, to ¼-inch long with 1 seed to a fruit.	Flowers, to ¾-inch across, white or yellow, somewhat like a little water lily, borne on long stems from bases of uppermost leaves. Petals and sepals, 3. Stamens, 3 to 6, with slender filaments. Carpels 3 and seeds 3. Ripened carpels may tend to separate. Flowers from May through August.
ECOLOGY	Flowering takes place from August to September, with mature fruits being present in the North from September to November, and in the South as late as December. Fruits, leaves and wintering buds provide superior food for ducks, particularly canvasbacks, which feed on them readily.	Provides food for small water animals that provide food for useful fishes. Plants may also provide cover for the smaller fishes. In some areas, is considered valuable as duck food, but certainly is not the best for this purpose. Some closely related species do not have the narrow leaves.	Fresh water shrimps and other small water animals abound in masses of hornwort and provide food for nearby fishes. Requires little light, but may pollute water and form almost inpenetrable barriers. Branch tips become crowded with leaves in fall, break from plant and sink to bottom for winter.	Eaten sparingly by waterfowl and not considered a superior duck food. When grown in aquariums, seems to be free of offensive odors common to many other water plants, and leaves are likely to produce less aquarium trash than most plants. Wide leaves lend great beauty to aquarium set-up.
ECONOMY	Can be transplanted successfully and this is done in wildlife management practices. Also eaten by moose, muskrats, deer and fishes of many kinds. Worthy of study and management.	Rarely, if ever, becomes the menace to traffic through water that the related water hyacinth does. The rather long list of ducks that feed on it indicates that it is useful in spite of its contribution to the water pollution problem.	Poor aquarium plant but grows rapidly. May give off bad odor. Muskrats and some ducks, such as black duck, redhead, ringneck, bluebill and wood duck known to feed on the plant. Brash nature of plants makes them harsh and uncomfortable to swimmers who may come in contact with them.	Aquarium plants do not commonly produce the floating leaves or the flowers, so their prosperity is probably seriously limited under aquarium conditions. Plants are set in aquariums by weighting sections of stems, or sinking them in earth on bottom. Known as fanwort and fishgrass in trade.

WATER FENNEL. WATER STARWORT *Callitriche palustris*	WATER MILFOIL *Myriophyllum exalbescens*	MERMAID WEED *Proserpinaca palustris*	MARE'S-TAIL, BOTTLE-BRUSH *Hippuris vulgaris*	BLADDERWORT *Utricularia vulgaris*
Stems, to 10 inches long submerged or rising weakly over mud flats. Submerged leaves are slender 1-nerved, to nearly 1 inch long, opposite. Floating leaves are broader, dotted with scales. Some forms show no floating leaves whatever. Length of stems may vary with depth of water.	Stems, to about 3 feet long, branched or unbranched. Leaves, submerged, in whorls of 3 to 5, to 1½ inches long, divided like parts of feather into about a dozen pairs of hair-like segments, with central axis about the width of the segments. Leaves near the flowers entire and whorled.	Stems, branched or unbranched, to 20 inches long or longer under water, smooth. Leaves those growing out of water to 2 inches long and ½-inch wide with sharply toothed margins. Submerged leaves alternate, with parts like those of a feather and with segments rather stiff and with a narrow black spine in axils.	Stems, to 2 feet long, or longer, unbranched, smooth, completely submerged or with two to 6 inches raised above water surface. Roots freely at the joints in lower areas of the stems. Leaves, in whorls of 16 to 12, narrow, without petioles, to 1 inch long and ⅛-inch wide, pointed at the free end.	Stems float horizontally beneath the surface of the water and extend 3 feet or more, branching sparingly. Leaves, alternate, to 2 inches long, divided into 2 at base and repeatedly twice-divided. Some leaf segments are bladders that assist in flotation and in food getting. No roots.
Order Geraniales. Family Callitrichaceae. More than 40 species found almost worldwide in distribution except in South Africa. This species ranges through most of the United States, except the southeastern area and is found in Europe, Asia and South America. The West lists 5 species, the East, 4.	Order Myrtales. Family Haloragaceae. Native of North America, but also found in Europe and Asia. Listed West Coast species, 2; East Coast species, 8 varying with the authors, with this species appearing on West Coast by some as a variety. Found mostly in warmish ponds and streams. 20 species in all.	Order Myrtales. Family Haloragaceae. Two species in United States, *P. palustris* ranging from Wisconsin to Oklahoma and Texas east to Georgia and Maine, and *P. pectinata* ranging through seashore States from Texas to Maine. Both in shallow ponds and streams often in shaded areas.	Order Myrtales. Family Hippuridaceae. Ranges from Alaska to southern California and east to the Atlantic north of Mason-Dixon line. Also found in Europe, Asia and Patagonia. In fresh water, usually with considerable current, favoring hard waters. Essentially a northern species.	Order Polemoniales. Family Lentibulariaceae. One fossil species known, but living species are found almost worldwide in distribution, with bladder-bearers in Northern Hemisphere. Some forms live out of water. This species ranges from Yukon to Lower California and east to Newfoundland and Maryland.
Flowers are borne in the axils of the leaves. There is no calyx or corolla. There is one stamen and 1 4-celled pistil, with one seed in each cell. Fruits are compressed, with winged lobes and in this species with 2 bracts about 1/10-inch long and about twice that broad. Flowers appear in July to September.	Flowers held above water in spikes bearing whorl of short leaves. Spike with flowers is to 3 inches long. The 4 petals in each flower drop early. Stamens, 8. Fruit small, bearing a wide groove between 2 ridges. Lower flowers, pistillate; upper, staminate. Flowers appear from July through September.	Flowers, solitary or in small groups, borne stalkless in axils of leaves that are above water. Fruits, to ¼-inch wide with concaved sides and thin or winged angles, sometimes pyramidal in shape. Flowers bear both stamens and pistils, lack petals and bear a 3-sided calyx tube. Stamens, 3 and stigmas 3. Green-white flowers.	Flowers, with stamens or pistils or both. Petals lacking. Calyx, tubular or barrel-shaped and adhering to mature fruit, which may be 1/10-inch long. Flowers, in middle or upper leaf axils. Fruit, nut-like and one-celled with the stigma persisting. Seeds apparently hollow.	Flowers borne 6 to 20 on stems to 8 inches long which extend above water surface. Flowers, yellow, to 5/6-inch long with broad lower lip, 3-lobed border. Blooms from May through August. Fruit, a several-seeded capsule and borne on recurved flower stalks.
This species is found mostly in cool quiet water, or even in cold running water. It appears at its best during spring and early summer, and will grow through the winter, even in ice-covered water. The leaves appear refreshingly bright green in such cold water. Upper leaves may be at surface.	Cannot tolerate 1500 parts of alkali to 1,000,000 parts of water. *M. scabratum* can survive in mud after water level has dropped exposing the plants. Plants are eaten by waterfowl, muskrats and moose, but on the whole are relatively unimportant sources of food to them.	Seeds are reported as a minor food for wildfowl. Rarely eaten by swans and sparingly eaten by muskrats. 15 species of ducks have been known to feed on the fruits, with mallards leading the list, one of which ate 220 for a single meal. In Connecticut, is considered important to black duck, wood duck and teal.	Fruits known to be eaten by 23 species of ducks and 2 species of geese, but most favored by bluebills and mallards. One pintail took 640 fruits for one meal; a bluebill, 970; a mallard, 1090. Because of northern range is important food in the major duck breeding grounds.	Found in waters up to 3000 parts alkali to 1,000,000, or twice alkalinity of hornwort. Bladders capture minute water animals such as water fleas that enter an opening, are held and die. Physiological story of use made of this is not wholly understood, but it is assumed that the fleas feed the bladderwort.
Gland-like structures under the leaves become inflated with air and float upper parts to surface where pollination takes place. The plant is of some value to aquarists, but requires cold water. It may multiply too rapidly for comfort. It has been reported as food of some kinds of ducks.	Provides excellent shelter for small organisms that serve primarily as food for fishes, but may also provide shelter for mosquito larvae. Because of dainty beauty is popular with aquarists, who propagate the plant by breaking off sections and fastening them to the bottom.	Aquarists consider the plants as valuable because of hardiness and because of obvious strong powers in adding oxygen to waters in which they grow. The beauty of the plants also makes them popular to aquarium fans.	Aquarists like beauty of plant, but it exhausts oxygen from water up to time of flowering, when it sinks to bottom and should be removed. Transplanted easily by breaking roots and planting segments. Known as cat's-tail, knotgrass, joint-weed, paddock pipe and witches' milk.	Moose, deer and many aquatic birds that feed on plants feed readily on bladderwort. Is eaten only sparingly by muskrats. Provides excellent cover for fishes, and organisms on which they feed. Nutritive value for ducks has been questioned. Some species are popular aquarium plants.

(*continued from page 363*)

serve in this way by providing food for the animals on which the fishes feed. They also provide cover for the fishes, and for the animals on which they feed.

Managed fish ponds usually are so constructed that there is little shallow water around the margins. A common test as to how murky the water should be to keep these plants under control is to observe if one's fingers can be seen if the arm is thrust down into the water as far as the elbow. If the fingers cannot thus be seen, it is generally accepted that the light will not penetrate deeply enough to support the plants.

There are reasons, however, why in some ponds these plants should be encouraged. For instance, they provide food for ducks, for large animals such as moose and deer, or for some of the furbearers such as muskrats and beavers. This means that if we are to manage a pond we might first make up our minds for what purposes we wish to manage it. Ducks and furbearers may be as valuable as a few crappies or bluegills, or even a few trout. In the 60th special insert, entitled "On the Level," we pointed out how important it might be to manage the margin of a body of water for wildlife, flood control, power and recreation. There we showed that in some cases failure to manage such an area might well demand complete removal of the fish and wildlife so popular with most persons.

Water, of course, is also valuable for drinking purposes and for irrigation. In these cases, it is important to keep it pure and free from contamination. When plants are present in too great abundance and begin to decay, they may foul the water and make it undesirable. Accumulation of wastes may also increase the number of animals that feed on these wastes. Sometimes this is not desirable, as in the case of some noxious insects, some pond snails that may carry diseases, and some fishes that thrive on wastes but are useless to man and injurious to the more desirable kinds of fishes.

As is shown in the chart section, some of these plants are resistant to pollution and can thrive where others cannot. If, in the future, more and more of our streams become polluted with domestic wastes, it is possible that these plants may find a function not now appreciated.

The chemical nature of waterways obviously varies greatly. Contamination with wastes from civilization and from industry may affect the prosperity of some plants and animals. Also the amount of salt, alkali and lime in water may determine seriously the value of a body of water. Those of our plants that can live in waters varying greatly in the concentration of some of these things may make them much more valuable than those plants that are more specific in their requirements. This is true not only in areas where fresh waters meet salt waters along our coasts, but inland, where many ponds become dry in summer and rapid or prolonged evaporation may change critically the concentration of salts in the water. Where these changes are likely to take place, some reasonable management may be effected by the introduction of species not affected seriously by a wide range of concentration of salt, alkali or lime.

Clasping-leaved Pondweed

Mare's Tail

As is shown in the chart section, some of our shallow water plants have direct economic value to man. Sea wrack has been harvested extensively for use in filling pillows, and for sound insulation. With the destruction of this plant by disease, this industry was practically wiped out. It would not be surprising if some day we found real food value in some of these plants that grow in areas not now producing plant food for consumption by man. If you have ever nibbled some of the tubers of arrow leaf, or the winter storage units in eel grass, you will realize that food is to be found in these plants if you know how to get at it.

Of course, there is always the value of these plants to students that should be recognized. What would high school biology be without elodea? Scholars who know these plants well have been able, through studies of the food found in ducks, to get some clues as to the paths followed by these birds in migration. This may be important in planning harvesting programs that are reasonable and that will guarantee the continued existence of these birds, which so many of us enjoy just seeing.

More mundane may be the importance of these plants in affecting traffic along waterways. Outboard motors may be effective in some waters, but in a waterweed-clogged stream they may be useless. Unless some of our waterways can be kept open to traffic it may be difficult to service some humans who live in areas not accessible by ordinary highways. Then, too, such waterways become too plant-crowded even to support fish populations. Some have recognized value in powerful animals such as alligators, which can make their way through such plant masses and, incidentally, assist in keeping open a path that may be followed by boats.

One thing is certain that increased knowledge and understanding of these plants may have a profound effect on our ability to make the best use of areas covered by fresh water.

Which Do You Prefer?

An Editorial

"We need strong highway zoning legislation to protect our highways and beautiful countryside from the squalid ugliness that mars so many of our roads."

These are the words of Governor Leader of Pennsylvania speaking to the State Legislature on the subject of economic development of the Keystone State. Agreeing that the highway system plays a part in developing travel and the vacation industry, and that the State may properly do some tourist travel promotion, he asserted that the answer did not lie in "talking generalities and printing pretty pictures." This is sound sense.

What the Administration, the Congress and the States will do about the proposed multi-billion-dollar highway program remains to be seen. That something needs to be done, and quickly, was emphasized by the Clay Commission. With that motor-minded America agrees. Whatever the program may be, it is also directly related to the environment of the highways; with the roadside.

At the top of this page are two views. One shows a succession of billboards—including, of all things, an official "safety" sign—dangerously placed on a curve. The other picture shows a modern, divided highway innocent of the distraction and ugliness of such highwayside parasites. Millions of Americans, on vacation travels this summer, are going to see similar contrasting situations. They are certain to conclude for themselves which they prefer, and we have no doubt of their choice as to which kind of highway environment they want.

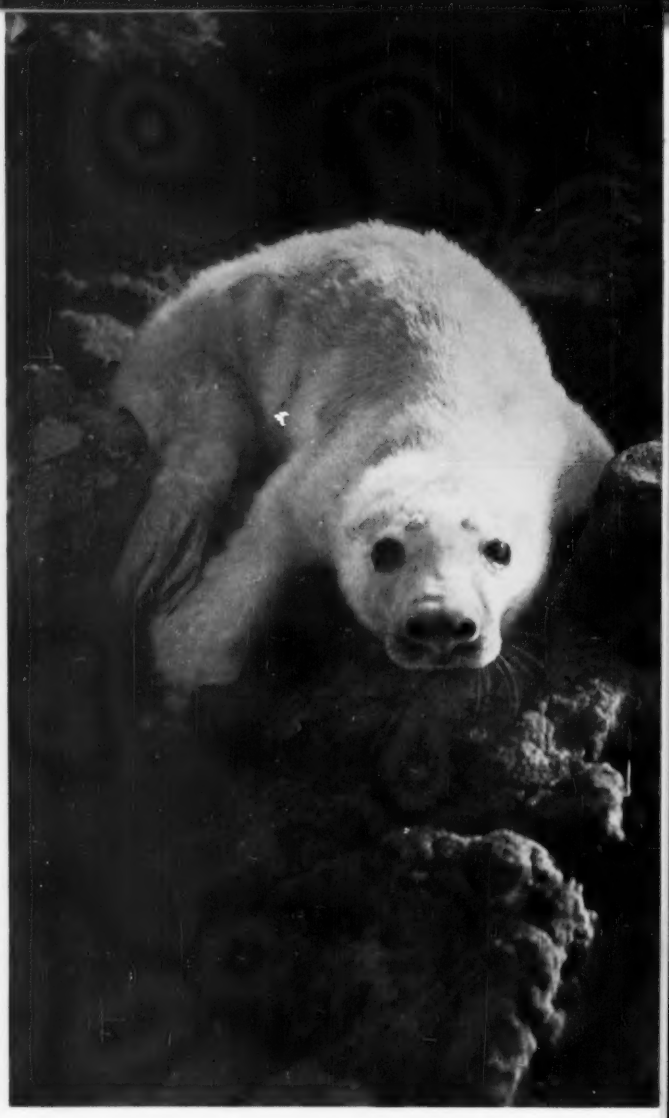
A perfect case in point is Route One from the National Capital to Baltimore. Along its entire length sprouted billboards and roadsides enterprises of largely hideous and uninviting character. Neon signs compete with traffic signals at the expense of the latter. Auto dumps add to the charm of travel over that route. All these conspired to make this one of the most dangerous highways in the country, and Route One, south to Richmond, is little better.

Then a splendidly engineered parkway was constructed from Washington to Baltimore. Route One businessmen screamed loudly when traffic went the new way, unable to recognize their contribution to the roadside slum into which they had converted this erstwhile main highway. Thus far the new parkway is free of billboards, thanks to a reasonably wide right-of-way for most of its length. But this is no guarantee that the billboard people will not seek sites as close to the parkway as they can get them.

Aside from the power of the well-heeled outdoor advertising lobbies in every State capital, there seems to be no reason why the public should continue to endure this sort of thing. It is the public that foots the bill—the twenty-five-billion-dollar bill for the interstate system of highways alone. It is the public that pays the toll on turnpikes. But it is the billboard industry that parasitizes upon this vast investment, renting sites for their distracting and incompatible signs for a pittance compared to the general expenditure.

Yet every time an effective zoning bill appears, seeking to protect the highway safety and beauty, lobbies swing into action. Organizations that have been given free billboard space for good causes are reminded of their indebtedness. Labor unions, farmers and others are lured into opposition by various devices. As a result, effective roadside control is defeated, or legislation is watered down to the point of being meaningless, or is defeated.

Governor Leader is so right! Strong highway zoning legislation *is* essential. As a matter of fact, it is about time that such a philosophy be incorporated in any plan for highway development on a national scale. The Federal Government should take the lead in this, and should specify that allocation of funds for interstate highway development is contingent upon a definite policy and program for proper control of the environs of the highways to be built. Such policy is reflected, in one form, in S. 1160 and S. 1048, as well as H. R. 4260, now before Congress. This means control of the roadsides in the interest of safe and enjoyable travel. Certainly it is not too much for those who pay the bill not only to expect but to demand that such a philosophy be enacted into law



This exasperated little fellow, three to four days old, looks up with wonderment in its soft, watery eyes, and hopes that he will soon be left alone. Its thirty pounds of body is comfortably lodged between the rocks and is not yet self propelled

Gray Seals of the Farnes

By GORDON S. SMITH

Photographs by the author

THERE are two species of seals that occur in the British Isles, the common seal, *Phoca vitulina*, and the gray seal, *Halichoerus grypus*. The latter is the rarer, and, as at least half the world population is found on the coasts of Britain and on its small surrounding islands, local naturalist have studied them. The gray seals breed off the coasts of Ireland, Scotland, Wales, southwest England and the Scilly Isles. On the east coast of Britain, however, there is only one colony and this is on the Farne Islands—a group of some twenty rocky, storm-swept spots three to four miles off the Northumbrian coast.

These tiny islands have been the home of the gray seals for at least 800 years. However, the local colony had never grown larger than about one hundred because of killing by local fishermen for the oil obtained from the seals' carcasses. In 1932 an Act of Parliament gave the animals some protection, forbidding any killing during the breeding season of September to December. A count in 1938 showed an increase of one hundred percent, and during the next twelve years the seals prospered, numbering about 1300 in November, 1950. By the spring of 1953 the colony had increased to 1750 individuals.

Certain studies had been made in the past, and recently Grace Watt and Dr. Ian M. Telfer, two members of the Natural History Society of Northumberland, studied the seals with greater success. They tabbed the calves in order to plot the range and route of their individual migration. Thus the zoologists sought to obtain figures on the rate of growth, and eventually to discover the life span of the species. As this work commenced in 1950, it is obvious that more time is required for a complete story, but the working observations thus far are of considerable interest.

The identification tags used were similar to the cattle ear tags employed by Scheffer on the fur seals of the Pribilof Isles. Seals are observed on the islands throughout the year, and it was thought that they never wandered far. However, after ten calves had been marked on December 16, 1951, one calf was recovered, fourteen days later, at Jaeren, near Stavanger, Norway. This animal, not more than six weeks old, had traveled some 400 miles, which was regarded as quite a feat. Others have been recovered from Utsire, Norway, as far north as Fraserbourg, Scotland, and as far south as Great Yarmouth, England, all within five weeks of the date of birth.

During the tagging, each of the calves is weighed and measured. The average weight was thirty pounds and the length thirty-six inches. Observations show that their weight increases by thirty pounds per week for three to four weeks, after which the cows leave them to

The Farnes is a group of some twenty, small storm-swept islands three to four miles off the Northumbrian coast of Britain. Visiting naturalists can make the trip only during comparatively calm weather, because of the rocky formation of the islands. The "mule," or local fishing boat, is shown laying off, under the watchful eyes of the fishermen as they meditate on the weather and the seas.

fend for themselves. The accumulated fat, which is thick blubber under the skin, then diminishes and reduces their weight, sometimes to as low as 57 pounds. Naturally the little fellows become hungry and are forced to leave the islands and enter the sea for more food.

An essential preliminary to weighing and measuring is determining the age of each individual. This has been one of the most difficult parts of the work. For quite young seals the condition of the umbilical cord proves an accurate guide, but for the older calves the indications are that when it has dark hair on its face it is ten to fourteen days old; when it begins to shed its first coat it is fourteen days old; when it has its complete second coat it is from five to six weeks of age. However, studies show that these data are not always dependable.

It is worthy of note that this work has aroused the interest of British naturalists Professor H. R. Hewer and Dr. L. Harrison Matthews, F.R.S., the latter Director of the Zoological Society of London. They have fostered sponsorship by the Zoological Society of a program to extend these studies to other colonies in Britain.

I SHALL NOT DIE

I shall not die—
The heart of me that can make
A tree, a bird, or soft snowflake
Breathe a song into my ear
Will live on in you, My Dear.

I shall not die—
This heart of mine that loves the way
The fox grapes hang and wood harps play,
And thrills to watch the wild deer run
Will live on in you, My Son.

Mary Cordell Nesbitt

The great dragon tree of Icod de los Vinos, Canary Islands. It is four hundred or more years old. The photograph is of a mural in the Chicago Natural History Museum, the mural having been painted from a photograph of the tree.

A DRAGON, hungry for elephant's blood, lies in wait for his victim. The hapless elephant passes by, and a battle ensues. Both beasts are killed, and their mingled blood congeals into that substance which the apothecaries call *Sanguis Draconis*—Dragon's Blood.

This fanciful explanation of the origin of the various red resins known by this name was recorded by Pliny in his *Natural History* in the First Century, A.D. Belief in the animal source of these resins actually persisted until as late as the Sixteenth Century, when essentially the same tale of the elephant and the dragon was repeated and enlarged by John Locke in the description of his second voyage to Guinea. In reality, the story of Dragon's Blood centers upon bizarre plants found in fabled places, for the resins are derived from giant members of the lily family, the dragon trees of the Canary Islands and of Socotra, an island in the Indian Ocean south of Arabia, and from certain climbing palms of the jungles of Malaysia.

Since before the time of Christ, Dragon's Blood has been used medicinally, and, in the East, the resin is still employed to combat certain eye diseases and pains in the stomach. In olden times in Europe it was administered internally in cases of dysentery, hemorrhage, and diarrhoea. Externally it was applied to dry ulcers and to promote the formation of scar tissue. Because it was considered a great "gum strengthener," it was often an ingredient of tooth powders. Colored dentifrices are nothing new!

As a coloring agent, Dragon's Blood has had wide utilization. The great Italian violin makers of the Eighteenth Century used the resin in varnish for their instruments. Socotrans use it to color pottery produced on the island. It has been used in mahogany stains and to color marble, and, in the Orient, to dye rattans, bamboos, and cloth. It is said to be one of the ingredients used by the Hindus to make the pigment for the "pottu," a circular mark painted on the forehead.

Masses of Dragon's Blood have been found in the burial caves of the Guanches, the aboriginal inhabitants of the Canary Islands. This has led to the assumption—apparently unfounded—that these people used the resin to embalm their dead. Dried Guanche corpses, found at one time in great numbers in Canarian caves, were brought by the shipload to medieval Europe, where pieces of them and Dragon's Blood were important ingredients in the concoction of certain medical and mystical potions. Guanche mummy and Dragon's

DRAGON'S BLOOD

By JOHN W. THIERET

Photographs from Chicago Natural History Museum

Two young specimens of the dragon tree of the Canary Islands growing in the Botanical Garden at Grahamstown, South Africa. The larger of the two specimens is about fifteen feet tall.

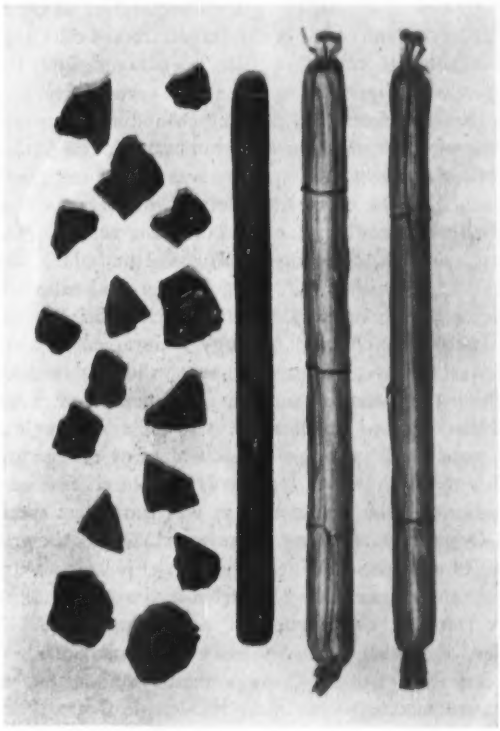
Blood are said to have been used even in the "Philosopher's Stone," that elusive preparation supposed by the alchemists to have the power to change other metals into gold or silver, to remove the "seeds" of disease from the human body, and to renew life.

Today the main use of Dragon's Blood is in the manufacture of colored spirit varnishes and lacquers for metals, and in the preparation of zinc line engravings to protect from the acid those portions of the metal not to be etched. Dragon's Blood has been replaced, to a great extent, by various synthetic resins derived by means more prosaic than from fantastic battles between great beasts. Synthetics, however, can never replace the colorful account that makes up the history of the Blood of the Dragon.

The first of these resins to attract attention was that of the dragon trees, *Dracaena cinnabari*, of the island of Socotra, and also of those in adjacent Africa. The Greeks and Romans, who held it in high esteem for its supposed medicinal properties, knew it as *kinnabari*, an article of trade from the Red Sea. During the First Century A.D., it was mentioned as a product of the island of Dioscorida, the ancient name of Socotra. Dragon's Blood—along with frankincense, myrrh, storax, and ostriches—was one of the commodities carried by the Arabs during their considerable trade with Malaysia from the Tenth to the Fifteenth Century. It is interesting to note that early travelers in the East Indies—now the main source of Dragon's Blood—either make no mention of the resin in their enumeration of the products of Java, Borneo, and Sumatra, or state that the Dragon's Blood used there came from Socotra.

Less than a century ago Socotran Dragon's Blood could still be found on the London market, where it was often called "Zanzibar Drop" because much of it came to England via that East African seaport. Although it is still listed as one of Socotra's chief exports, but little Dragon's Blood is sent today from the island, and most of this goes to India. The resin is exported in two grades. Prime quality is in the form of beads or drops,

These irregular pieces of resin, and resin in "reed" form, are the palm Dragon's Blood. The reeds are about eight inches long. The wrapping—probably pandanus leaf—has been removed from one stick.



which are exuded by the dragon trees from cracks or fissures in the bark. The second quality is obtained by bleeding the trees. A portion of the bark about two inches square is scraped off, and in two or three weeks this space fills with resin. This, after being collected, is softened by heat and molded into cakes. The natives gather the resin by chipping it off the tree with a knife into a piece of goatskin.

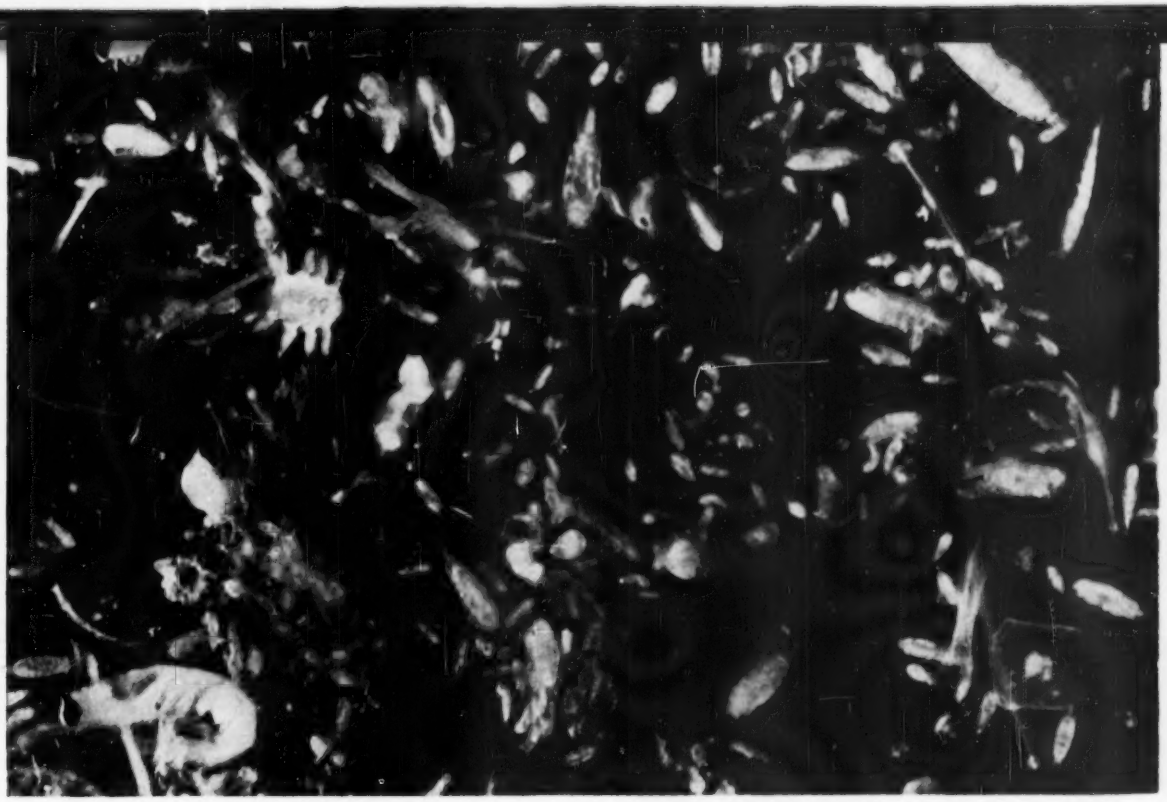
For the second chapter in the history of Dragon's Blood we leave Socotra and travel some 5000 miles westwardly to the Canary Islands. The time is the beginning of the Fifteenth Century, when the ships of the "Conqueror of the Canaries," Jean de Bethencourt, reached Gran Canaria and established a brief exchange of goods with the inhabitants. One of the products offered by the natives was Dragon's Blood, which was collected from the dragon trees, *Dracaena draco*, of the islands. The foreigners regarded the resin as a most valuable item, and in their journal tell us that "the Dragon's Blood was well worth 200 ducats, while what was given in exchange—fishing hooks, old iron, and little knives—was hardly worth two francs." Although this is the first record of this resin in the Canaries, it seems almost certain that previously it had been an article of commercial exchange between the Canarians and various European navigators who occasionally reached the islands. After the Spanish conquest of the Canaries near the end of the Fifteenth Century, the resin was an article of export for a brief time only. Soon it passed out of the picture and became what it is today, an object of curiosity.

We should not leave this brief account of Canarian Dragon's Blood without mention of one of the most renowned of plants, the giant Dragon Tree of Orotava. The largest and oldest of the dragon trees of the Canaries, this colossal cousin of lilies, asparagus, and Joshua trees was supposed to be about seventy-five feet in height and seventy-eight feet around the base at the time of its destruction by a hurricane in 1867. In the hollow trunk of the tree there was built a staircase that reached to the point where branching began. The age of this remarkable plant has been the subject of much discussion. According to Baron Humboldt, it was 5000 to 6000 years old; Sir John Herschel called it the oldest tree in the world; the French naturalists of the catastrophic school of geology maintained it was "so old as to have witnessed some of the last revolutions which the surface of our planet underwent prior to the advent of man." Such remarks as these, although made in good faith, are now considered great exaggerations. This much, however, can be said without fear of contradiction—the Orotava giant was the oldest specimen of *Dracaena draco* known. A recent student of the growth rate of this species points out that it grows rather rapidly and can attain in ten years from seed a height of about six feet and a circumference of thirty inches. Using these and other data as a basis for calculation, he estimated the age of the Orotava tree to be about 840 years, a less spectacular but more reasonable figure than the 6000 years of Humboldt's calculation.

Details of the Dragon's Blood palm from Kohler's *Medizinal-Pflanzen* (1886). Much reduced, the drawing shows a fruit cluster and leaf. Smaller drawings are of plant, flower, fruit and inflorescence.

The Socotran and Canarian Dragon's Bloods are vermilion to deep red-brown. They give off aromatic, irritating fumes when decomposed by heat and, when dissolved in alcohol, produce a blood-red solution. From the rest of the forty or more species of *Dracaena*, the dragon trees are a distinct group characterized not only by the production of these resins but also by the thick trunk and the stiff, sword-like leaves, which form dense tufts at the ends of the stout branches. The flowers, about one-fourth to one-third of an inch long, are borne on a branched, flowering stem, which arises from among the younger leaves. These blossoms are similar in size and shape to those of one of our most common house plants, the bowstring hemp or "mother-in-law's tongue" of the genus *Sansevieria*, perhaps the closest relative of *Dracaena*. The antiquity of the dragon trees, their singular appearance, the size that they attain, the blood that oozes from their trunks—all these impart an air of mystery to the plants and make them objects of great interest, both in their home islands and in numerous botanic gardens throughout the world.

The *Dracaena* resins are often referred to as "ancient" Dragon's Blood because they are mainly of historical interest. Most of the "modern" Dragon's Blood on the world market comes from Malaya and the East Indies, and is obtained from plants markedly different from the massive dragon trees. It was not until the Sixteenth Century that this Malaysian resin appeared, brought westward by Arab traders. The first mention of such a resin from Sumatra is (*Continued on page 388*)



The wide variety of plant and animal life of the sea caught in a plankton net towed near the surface at night.

One way or another, all sea life depends upon

THE WANDERERS

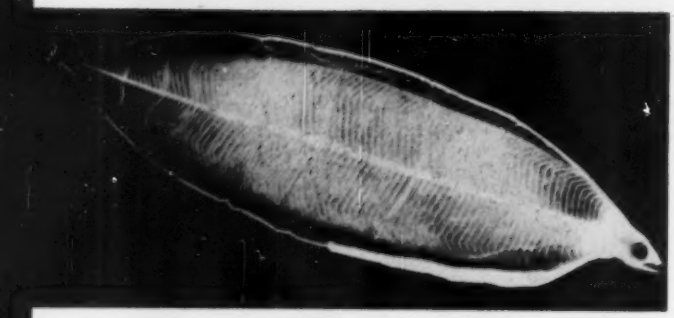
By JOHN B. LEWIS

It is believed that life began in the ocean, and that the ancient seas teemed with life before any living creatures appeared on land. Today, even taking the greater size of the oceans into consideration, their fauna and flora still overwhelmingly exceed that of the land. Every part of the sea, from the surface depths of several miles, has its characteristic form of life. Certain areas, especially the shallow platforms encircling the continents, are more productive than others, but nowhere is the sea devoid of life.

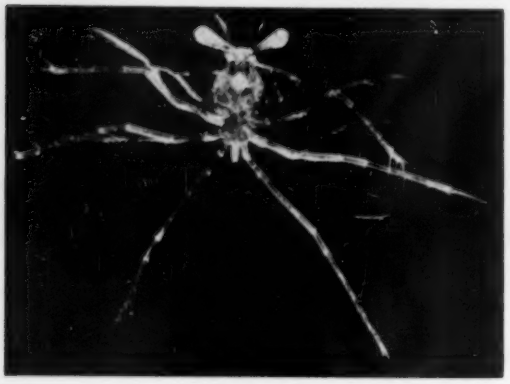
There is one community of plants and animals upon which all this life in the sea depends, either directly or indirectly. This is the plankton, whose name means the "wanderers." It consists of countless numbers of tiny plants and of animals that cannot swim strongly enough to make their way against the currents of the ocean. Much of this life is so small as to be scarcely visible to the naked eye, but under the lens of a microscope it appears as a fantastic world in miniature. There are single-celled plants fashioned in surrealistic designs with sharp projecting spines or whiplike appendages that ceaselessly lash about; small square boxes of plants strung together to form long chains and clusters; or plants whose cell walls are protected by two exquisitely sculptured shells that fit together like the two halves of a pill box. These plants are extremely abundant and form the food of the small animals living in this drifting community. Just as all animals on land are ultimately dependent on grass and herbs for their food, so, also, in the sea the basic food supply is to be found in these tiny plants.

The animal life of the plankton is an incredible zoo of grotesque creatures, as of another world. Pop-eyed fishes feed upon many-spined crustaceans that swim jerkily past by means of their antennae. Spiny-jawed arrow worms feed voraciously on plant and animal alike. Transparent salps squirt water through their bodies in the manner of tiny, jet-propelled engines. The crustacean *Phronima* eats the bodies of these salps and the female incubates her eggs within the empty, barrel-shaped carcass.

By far the commonest animals of the community are the copepods. These are minute crustaceans, many of which live their entire lives among the plankton.



The planktonic larva of the eel is leaf-like and transparent, and no more than a quarter-inch long.



The young of the spiny lobsters live for almost a year among the plankton before being carried toward shore, there to moult.

The larva of the squid is an exquisite little creature, diminutive of its parents, even to the little blobs of ink it releases.

Some are rounded and equipped with the most beautiful arrays of feathery spines; some are flat and transparent, others are irridescent and shine with almost every conceivable color. The brightly colored eggs of copepods are carried in bunches like grapes underneath the body of the female. Each egg hatches into a minute creature called a nauplius, which is totally unlike its parents. Its rounded body bears three pairs of spiny, tufted limbs that are used for swimming. As the nauplius grows and moults, each stage resembles more and more the adult, and the limbs that were first used for swimming serve as the antennae and jaws of the adult. Copepods form the chief item of food of many of the larger animals in the sea. In northern waters the copepod *Calanus finmarchicus* supports the herring industry, and is often so abundant as to color the water red.

Perhaps the next most abundant animals of the plankton are the Euphausids. These are tiny, shrimp-like creatures that grow up to an inch in length and have transparent bodies and large black eyes. Along the underparts of their bodies are small light organs, which emit blazes of phosphorescence. Like the copepods, the female carries her eggs in clusters beneath the body and the young are born as nauplii. Euphausids form, almost exclusively, the diet of some of the large whalebone whales. These whales do not possess typical teeth but are armed with long thin plates on their upper jaws. The plates are frayed along their edges and form masses of fibers. Thus the whale feeds simply by opening its mouth wide to gulp in water and then closes the mouth to expel the water out through the plates, which filter out the animals that are then swallowed. The Euphausids must truly exist in tremendous numbers to nourish such gigantic creatures.

Plankton is the nursery of ocean life, for it is here that the young of many animals of the shore and deep sea are cast adrift to feed and develop until they reach maturity. A great many marine animals produce eggs that contain so little yolk for the embryos to feed upon that the young are unable to remain for long in the egg. Such eggs hatch in a short time and produce small larvae, which are usually quite unlike their parents. These larvae undergo further development in the plankton and must obtain their own food. Their existence is extremely precarious and the vast majority perish in an unfavorable environment, or are eaten by innumerable enemies. To make up for the loss of the early stages, most of the marine animals having planktonic larvae produce prodigious quantities of eggs. For example, the female spiny lobster liberates each year about half a million eggs. A number of animals produce several billions of eggs each year.

Among the animals having planktonic larvae are the lobsters and crabs. The young of the spiny lobsters are flat, leaf-like creatures, transparent except for a pair of dark eyes on long stalks and a few red pigment spots. They live for almost a year in the plankton before being carried by currents towards the shore and there moulting to tiny lobsters. The young of crabs, too, are totally unlike their parents. They are almost all head and eyes, with long projecting spines and feathery legs. In this stage it is called a zoea. After several moults it suddenly changes into a megalopa, a stage quite unlike the zoea and more like a crab.

Nearly all the invertebrate animals are represented in the plankton. Mollusks are usually thought of as living along the bottom, but they, too, are represented by a variety of groups. Of these the sea-butterflies, or Pteropods, are among the most beautiful of sea animals.

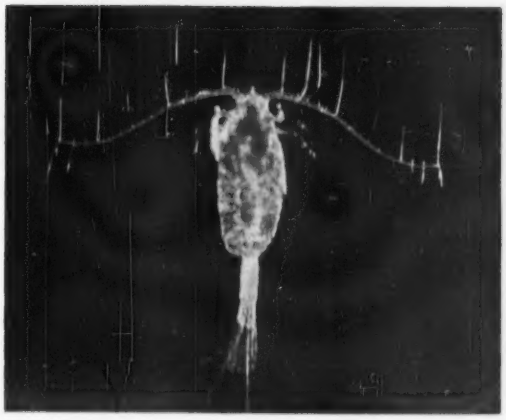
They move through the water with a flapping of what appear to be wings but which are really modifications of the foot by means of which most mollusks crawl. Many Pteropods bear fragile, delicately formed shells, some spiral, others tapered like a long tooth, and some looking somewhat like a small boy's kite. A northern species, which lacks a shell, is a rich blood-red in color and grows to be about an inch in length.

The mollusk group also includes the squids and octopuses, whose young are often found in the plankton of tropical and temperate waters. Like the adults, the skin of the young contains pigment sacs that can be expanded or contracted to produce color changes throughout the body. They are exquisite little creatures, diminutives of their parents, even to the little blobs of ink they release when frightened. One strange little octopus, *Cranchia* by name, has the curious habit of pulling its head inside its mantle when frightened. The head is pulled so far in that the animal is almost turned inside out and the eyes peer about at the source of its fright from inside its own body.

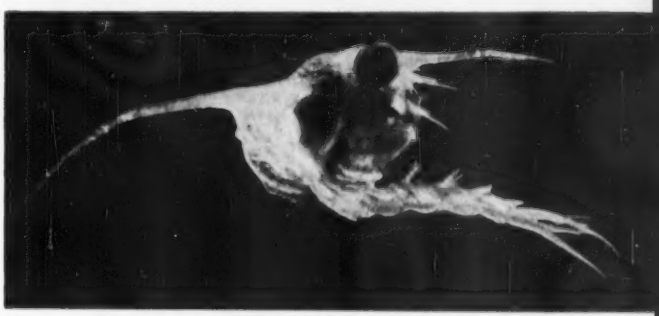
One of the most famous of the animals that begin life in the plankton is the larva of the freshwater eel. For years men were puzzled by the reproduction of the common eel, which thrived and multiplied in their streams and rivers and yet no eggs or young were found. Then, in 1922, a Danish oceanographer showed that a small fish inhabiting the warm waters of the Sargassum Sea was the missing child of the European eels. These larval eels were quite unlike their parents, being flattened sideways like a leaf and quite transparent. When no more than a quarter of an inch long they begin one of the most remarkable of journeys. Before reaching the streams of their home in Europe these tiny creatures undertake a journey covering thousands of miles and lasting about three years. When they have reached the coasts of Europe they undergo a change in form, losing their flattened appearance and assuming the rounded form of the elvers, which yearly ascend the rivers in countless numbers.

Although many land animals, like the firefly, possess the power of phosphorescence or glowing, it is much more common among marine animals. Many of the planktonic animals possess the power to a marked degree. To those who have seen it, this light, like thousands of tiny stars against a background of snowy white froth in the wake of a ship, is a wonderful sight. Besides these tiny flashes of light, one may often see larger diffuse patches of a pinkish-blue light, which begins slowly, flashes to a peak intensity and then slowly dies.

Phosphorescence in the sea is displayed by a variety of creatures, but the actual reaction is the same in all cases. The light is produced by the oxidation of a substance called luciferin in the presence of oxygen and a catalyst, luciferase. The reaction is essentially the same as any other oxidation process, as when a candle is burnt, but with this difference—light only is produced and none of the energy is lost as heat. This is one of the most striking properties of animal phosphorescence; it is what is commonly known as cold light.



The copepod is one of the commonest animals in the sea, minute crustaceans among the plankton.



The zoea stage of the shore crab is mostly head and eyes, projecting spines and feathery legs.

Ceratium is one of the plants in the planktonic community and is food for many creatures.

The smaller animals in the plankton, the single-celled ones, have no light-producing organs, but phosphorescence, when it is present, comes from small granules imbedded in the tissue. In many of the larger animals, the Euphausids for example, complex light organs are present. They consist of light-producing cells backed by a reflector that prevents loss of any light into the body. In front is a lens that focuses the light. A nerve connects this organ to the brain and (*continued on page 388*)

A tent caterpiller without a tent causes

Caterpillar Confusion

THE FOREST tent caterpillar, *Malacosoma disstria*, has been a source of concern to foresters and a downright nuisance generally since colonial days on this continent. This is especially so in the forested regions of the northeast. However, many people who have had first-hand experience with this insect do not know that it exists as a separate species. This is largely due to confusion with the common tent caterpillar, *Malacosoma americana*, also called the American, orchard, or eastern tent caterpillar.

The conspicuous white webs or "tents" in roadside and orchard trees and shrubs are familiar to all. The tent caterpillar's misnamed relative, which might better be called the "tentless" tent caterpillar, neither makes a tent nor lives in one. It lives entirely in the open from the time it leaves the egg until it spins a cocoon in which to transform into a small brown moth and begin the next generation. The forest species feeds at night, and rests by day in motionless clusters on the bark of trees, often high above the ground. Until, as a full-grown caterpillar, it begins to wander in search of a place to pupate, it is more likely to be detected from the damage it does than from seeing the insect itself. By the time attention is drawn to it by a rapidly diminishing supply of leaves, it is too late to apply an effective remedy.

Both species are subject to fluctuation in numbers from year to year, but the changes are much more violent in *disstria* than in *americana*. While the latter is always present, but more plentiful some years than others, its tentless relative seems to disappear altogether for as long as ten years at a time. Then it irrupts without warning in an area that may cover several townships, and strips the leaves from most of the deciduous trees for two or three consecutive years. Then the pest disappears as suddenly as it came. During these in-between periods people are inclined to forget what happened the last time, and since these

Feeding at night and resting by day, the caterpillars grow from a few millimeters to as much as two and one-half inches in about six weeks. They form masses numbering thousands. Part of one mass is shown above, and includes several orchard tent caterpillars, identified by the continuous white stripe down the back. (Right) An egg mass at the left completely circles the twig and from it emerge some 300 baby forest tent caterpillars. The eggs were laid by a female moth in July and were coated with a tough, shellac-like substance. Hatching occurs a few days before the tree leaves begin to unfold, during which time the caterpillars rest or wander slowly about.

By R. J. RUTTER

Photographs by the author

"peaks" usually coincide with a high year for the common tent caterpillar, attention is further diverted from the activities of the forest caterpillar by the unusual number of "tents" of the other species. And a good deal of wasted control effort is directed toward destroying the tents, which, unless they are in orchards, are usually confined to trees of little value and great resistance, such as wild cherry or hawthorne.

The forest tent caterpillar attacks not only wild and cultivated fruit trees, which are the main food of the common tent caterpillar, but is equally fond of poplar, sugar maple, oak, birch, and basswood. All of these will recover from an amazing amount of early summer defoliation, the slow-growing oak probably suffering most, but several consecutive years of infestation lower the trees' vitality and leave them more subject to damage by insects or disease.

In appearance the two are enough alike to deceive the unobservant, but anything more than a casual glance shows a quite different color pattern. The common tent caterpillar has a continuous white stripe down the middle of its back, and its sides are decorated with spots suggesting the "eyes" in a peacock's tail. The forest tent caterpillar has a chain of bottle-shaped white spots down its back, and its sides are blue. Both are beautiful creatures, if we are able to forget their habits.

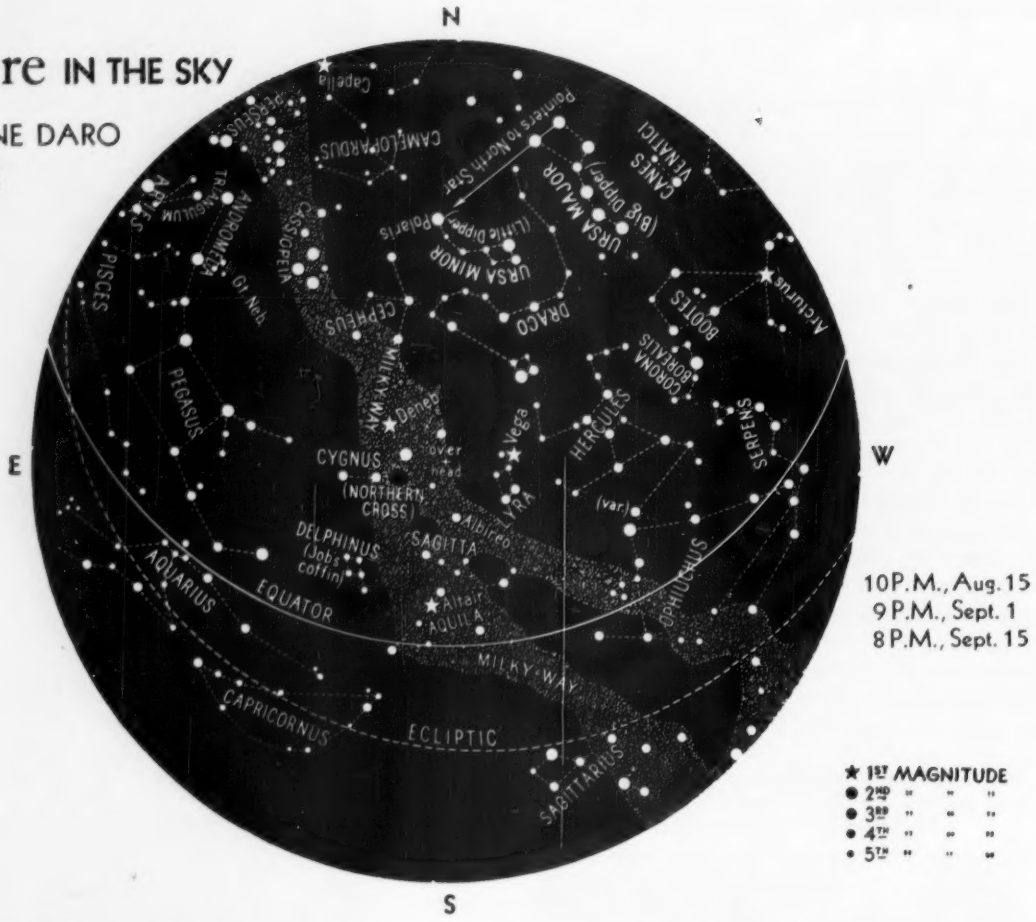
The forest tent caterpillar does not eat coniferous trees but will use them as sites for cocoons, as with the crown of this young red pine.

Close-up showing the difference between the markings of the two species, the common one having the continuous white line on the back.

About mid-June the caterpillars wander, looking for suitable places to spin cocoons. It is then they become a nuisance. They continue to cluster, as here on the old door. Note the two on the staple used as a fastener.

Nature IN THE SKY

By SIMONE DARO GOSSNER



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. Times given are for Local Standard Time.

Fingerprinting the Stars

In 1666, Sir Isaac Newton demonstrated that ordinary "white" sunlight is in reality composed of all the colors in the rainbow. He achieved this by allowing a ray of sunlight to pass through a triangular glass prism and to project itself on the wall. The resulting patch of light showed all the rainbow colors arranged in the familiar sequence, from violet on one end, to blue, green, yellow, orange, and red at the other end.

The role of the prism in this experiment is to refract, or bend, the light rays. The amount of bending depends on the color, or frequency, of the light. Violet has the highest frequency and is most refracted, whereas red has the lowest frequency and is therefore least refracted. Thus it is that the prism sorts out the colors, much as a radio receiver sorts out the frequencies of the various emitting stations.

Atoms and molecules in a glowing medium may be compared to the emitting stations. The atoms of a specified chemical element always emit light at the same frequencies. These frequencies are different for each element, and they are called the *spectrum* of the element. When the spectrum of a glowing gas is observed through a *spectroscope* (a mounted prism), it appears as an array of brightly colored lines, each line corresponding to one of the frequencies at which the atom radiates. Not all lines corresponding to a certain element will be seen at once. Their appearance is governed by the conditions of temperature and density of the emitting gas. Thus the observation of a spectrum not only reveals the identity of the element, but also gives a clue to its temperature and density.

The theories of modern physics permit the detailed prediction of the positions of the lines in atomic and molecular spectra. This makes it possible to analyze

the light from distant stars. According to the position of the lines, one can then identify the chemical elements that are present in the star. So, by comparing the relative strength of the lines, a good estimate of the temperature of the star may also be derived.

In the latter part of the nineteenth century, the Harvard College Observatory undertook a large-scale program of spectral classification. This was done photographically by placing a huge glass prism in front of the telescope objective, and bringing the spectra to focus on the photographic plate. In this fashion, the image of each star, instead of being a round dot, became a little rainbow. It was found that, like fingerprints, no two stellar spectra are identical, although they could be classified broadly into a number of categories with similar characteristics.

Since hydrogen seemed to be present in all of them, it was originally decided that those spectra where the hydrogen lines were the strongest would be called class A, the next strongest class B, and so on down to M, where they are very weak. Unfortunately, this neat alphabetical order was soon to be disrupted. Certain classes, such as C and D, had been introduced unnecessarily because of poor photographs. Moreover, the hydrogen sequence produced a discontinuity in the appearance of other lines. Finally, class O, discovered later, rightfully belonged to the beginning of the sequence, whereas N, R, and S had to take care of some oddities at the other end. The definitive order, still in use today, is O,B,A,F,G,K, M,R,N,S. Harvard, which created this confusion in the first place, happily came to the rescue of distressed students with the memorizing jingle "Oh, Be A Fine Girl, Kiss Me Right Now, Sweet!"

As it stands now, this classification is primarily a temperature and color scale. Class O and B stars are the hottest and bluest, with a surface temperature in excess of 36,000°F. A and F are white, G yellow, K orange, while class M stars are red and cool—a mere 5800°F.

On this basis, our sun is of class G, and quite an average star indeed. Because it is so near to us, its spectrum has been more thoroughly studied than that of any other light source. In 1868, it was found that a newly observed line was different from that of any known terrestrial element. A little too hastily, physicists assumed that it was produced by a gas existing only on the sun, and named it "helium" (from the Greek *helios*, sun). Twenty-nine years later, the same gas was discovered on the earth and identified spectroscopically with solar helium.

The analysis of the solar spectrum is a complex and time-consuming problem. Approximately 26,000 different lines have been recorded. Laboratory comparisons have demonstrated the presence of 67 known terrestrial elements, although the identification of a few may be somewhat uncertain. The enormous difference in temperature between the sun and the earth accounts in part for our failure to observe the others.

The most remarkable feature in the composition of the sun is the extraordinary abundance of hydrogen, about 80 percent by volume, followed by that of helium, about 18 percent. The remainder includes all the other elements. One should note, however, that the light that is observed originates in the outer layers, and that the composition at the center may include a larger proportion of the heavier elements.

Most of the stars have nearly the same composition as the sun, but, in some instances, especially in the cooler ones, other elements may tend to be a little more abundant. Some show an oversupply of carbon, others have more silicon or sulphur than may normally be expected. But it is an accepted fact that we do not expect to find, anywhere in the universe, a chemical element unknown to our terrestrial laboratories.

The autumn equinox will take place on September 23, at 2:42 P.M., Eastern Standard Time.

The moon will be full on August 3 and September 2, and the New Moon will occur on August 17 and September 16.

Mercury will enter the evening sky on August 5, and will set in the evening twilight throughout August and September.

Venus and Mars will be too close to the sun, and unfavorable for observation.

Jupiter, in Cancer, will rise about an hour before the sun on August 15, and about three hours before the sun on September 15.

Saturn, in Libra, will set at about 10:30 P.M. on August 15, and at about 8:30 P.M. on September 15. It will be visible low in the southwest.

The Perseid meteor shower will be observable from August 4 to August 16, with maximum on August 12.

THE STAR-GAZERS

"There should be shooting stars tonight," we said.
And so we waited late upon the hill
Until our last log shivered and was dead—
Until the dark came down, and all was still.
We leaned our backs against a giant oak
Whose branches wore a coronet of stars;
We named the climbing planets as they woke
And sought to find the winking red of Mars.

The sky was filled with stars, so bright and clear
Its splendor kept us spellbound watching there
Till space was non-existent; heaven was near,
And we ourselves one with the star-lit air.
And there, our ears attuned, we heard that night
The music of the stars. Then suddenly
A shower of meteors trailed its bluish light
In dazzling brilliance high above our tree.
They fell, the Perseids, in their annual display,
Arpeggios of light spilled down the Milky Way.

Florence Schneider

THE Nature CAMERA

By EDNA HOFFMAN EVANS

Geysers and Bears

A YEAR AGO WHEN I WROTE about photography in the national parks and monuments, I said that I had never visited the oldest and probably the best known of all the parks—Yellowstone. I felt a little ashamed at having to make such an admission, and I set about to do what I could to remedy the situation. In other words, I managed to get there, along with thousands of other vacationers, most of whom were equipped with at least one camera.

Like most of the national parks, Yellowstone's photographic possibilities are excellent, whether one merely wants a few snapshots of the geysers, or plans an extensive campaign to photograph the numerous wild creatures inhabiting the more than two million acres that lie within the boundaries of the park.

I approached Yellowstone National Park with mixed feelings because I had heard so many conflicting descriptions of it. One family I know reported that they had driven for miles and miles inside the park and "had not seen anything but trees." Another friend disliked the place because "there were always too many people under foot." I had read reports of how careless vandals had tossed all kinds of junk into the pools, spoiling their beauty forever. Even the "mendicant bears," as someone described them, were by implication not worth seeing. So, with all those reports in mind, plus a flat tire a few miles outside the park gates, I drove into Yellowstone late one afternoon with mixed feelings and my fingers definitely crossed against future mishaps and impending disappointments.

All went well, however. At supper-time the hostess at the lodge ushered me across the dining room to a table overlooking the geyser area, and Old Faithful erupted just as the soup was served. From that time on I knew that, regardless of what Yellowstone might have been to others, it was going to be a wonderful experience to me.

Pictures before breakfast

Promptly next morning, before the sun had cleared the treetops, I was out with camera in hand, for a tramp along Firehole River. The morning air was chilly and steam from the hot springs swirled up and around in a fantastic manner. I got some fine color pictures, even before breakfast. In fact, that was the only opportunity I had to get those particular pictures for the following mornings were warmer and the steam was never again so spectacular during my stay in the park.

That is something a photographer should bear in mind when he plans to photograph the geysers. The steam shows best in early morning, or in the cooler days of spring and fall. The traditional Old Faithful picture must have been taken at one or the other of those times, for I did not see it as steamy as the trademark pictures show.

There is a fascination about Old Faithful—at least there is to me. It is something that I think every American should see; something intrinsically American, like the Statue of Liberty, the Capitol dome in Washington, Independence Hall in Philadelphia, and the Grand Canyon. Somehow, it thrills me to think that, day after day, month after month, year after year, that geyesr goes on erupting, once every 60-odd minutes. I feel proud of that stately, dependable, faithful old geyser. And Old Faithful *is* stately. Other geysers may huff and puff, and snort and blow, but Old Faithful clears its throat a time or two, shoots a steady column of water and steam high into the air, and then settles down in dignified silence once more. Every time I was in the vicinity of Old Faithful at eruption time, I found myself lining up with the other camera fans to take a few more pictures.

Every person, I think, has to experiment and discover for himself

Old Faithful in action. Note that the figure of the ranger in the foreground serves as a yardstick to measure the extent of the eruption.

the best places from which to see and photograph an eruption because so much depends on contemporary conditions. It is best to stand some distance away, in order to get a picture of the whole show. Move in too close and you have to sacrifice either the top or the bottom of your picture.

People or not?

The photographer must decide, too, whether he wants people in his pictures or not. (Sometimes they are hard to avoid.) As a rule, I prefer Nature pictures minus human beings. However, in the case of the geysers, a few people—even though they are perfect strangers—do serve as yardsticks to give relative size. It is hard to estimate the height or extent of a geyser display without some basis of measurement. But try to keep your people subordinate to the main center of interest.

As for shutter speed and lens aperture, it is best to depend on a light meter for them, especially if you are using color film. When the air is clear, the western sunshine is so intense that it is extremely easy to overexpose one's shots. One thing to watch for, in early morning shots of Old Faithful, is the rainbow that forms in the steam and spray. I missed my chance at it because I was using black-and-white film at the time. But it was a beautiful

A yearling bear looks over the situation.

sight to behold, even though I was unable to record it on film.

When I was finally able to tear myself away from Old Faithful, I found the other geysers equally cooperative. (Actually, until I got to Yellowstone and saw for myself, I had not realized how many geysers are to be seen within the park area—more than 200 of them, all told.) The Giant put on a show for me after having sulked for some time previously. So did the Castle, the Grotto, and several other big spouters, while across the river from Old Faithful the dainty little Spray Geyser went off twice as often as its famous relative.

The pools were beautiful, and I had the breathtaking experience of strolling out on the plank walkway in the Midway Geyser Basin area while the sun was under a cloud. Suddenly the sun emerged and the whole beauty of the scene was revealed to me. The water turned turquoise, and emerald, and every shade of blue and green and purple that one could imagine. Beneath was the yellow of the rock bottom, tinted rose, and orange, and rust-brown by the minerals in the water, while the algae growing in the warm run-off channels added more color to the scene. Behind and beyond was the deep green of the pine forest, and above that was the blue of the sky. It was a sight never to be forgotten. Even the glitter of an occasional gum wrapper, discarded film box, or blob of tissue dropped by some thoughtless visitor, could not detract from the beauty of the scene. The vastness could not be completely captured on film, but I did my best.

Businessmen bears

Next to the geysers, I think the bears in Yellowstone impressed me most. Some people grow tired of them—call them beggars and bothers—but I prefer to think of them as local business-men, making the best of the opportunities offered by the never-ending stream of tourists. It even seemed to me that some of them had regular "beats," or places of business along the road where they would wait for people to come by and feed them.

A driver in Yellowstone soon learns that a cluster of cars parked along the roadway means "bear" and the eager cameraman promptly prepares to join the other shutterbugs in trying for pictures. This is probably the best way for a beginner to start taking bear pictures. There is usually safety in numbers, and so while somebody tosses potato chips, or cookies, or peanuts, or what-have-you to the bear or bears, the other humans can photograph as much and as often as they like. Remember, always, that the bears are "wild" and quite capable of showing resentment to undue familiarity.

Before long, this group type of photography gets tiresome, especially as somebody is apt to step in front of you just as you are ready to take a picture. I found that by waiting until the others drove on, or by noting the location of the bear and coming back to him later, I

(continued from page 387)

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Nature IN THE SCHOOL

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

POND PLANTS IN SCHOOL

STATISTICAL educators might find it interesting to make a survey to determine the use schools make of pond plants in the classroom. Offhand, one probably would say that such a study would be ridiculous; that almost no schools would have the subject matter available for use. Frankly, I question any such suggestion.

As a test, I picked up the most recent general science text to come to my desk. In it, under a heading discussing how "living things depend on each other," I find a diagrammatic representation of an aquarium. In it seem to be growing two common aquarium plants discussed in the special insert in this magazine—elodea and vallisneria. The discussion about these plants in the book is wholly inadequate, and no suggestions are made whereby the children can demonstrate for themselves the role these plants play in relation to oxygen and carbon dioxide. The book tells the youngsters what is what, but provides no guidance to the use of the basic authority. Our chart section suggests how some plants vary in their relationship to carbon dioxide and oxygen, and any reasonably ingenious teacher can put some of the different plants in aquariums with fishes and observe the results that should lead to the conclusions suggested in the book.

The book in question gives some help on cactus plants growing in a desert, but I am sure no cactus such as is shown in the picture can be found growing in any classroom. Small cactuses might be used to recognize that the information given in the book is invalid, but, as it stands, the children just have to take what the text says.

May I suggest that teachers have the children make, from local areas, as extensive collections as possible of the plants discussed in our insert. Put equal amounts of the different kinds in separate, equal aquariums, even though the aquariums are nothing more than fruit jars. To each aquarium stocked with a plant, add similar and equal animal populations. Note what happens to the plants and to the animals over a reasonable period of time. Do the animals eat all the plants, or do they show some preferences? Can the animals survive equally well when associated with the different plants? Once you have one set of data on this, try again to see if the results are confirmed a second time.

Identifying the plants

Since this article will be available when school opens in the fall, see if the children cannot learn to make reasonable identification of some of the plants by feeling, smelling and even tasting them. Make sure, of course, that they do not taste plants that have been growing in polluted water. Not only do these plants differ in their shapes, as may be shown by our drawings, but some of them are definitely coarse and harsh, while others are smooth and even slippery. Possibly you can suggest a reason for this without looking at the insert for help.

Put some jars containing equal amounts of elodea in different places in the classroom. Let one stand on a windowsill in bright sunlight; put others in darker places. If bubbles are not given off regularly from uninjured plants, break a stem to see if this changes things. Possibly what is seen may help to show the effect of sunlight on plant activities that result in the freeing of gases. Possibly you may be interested in chemistry, and the children may demonstrate what gas is given off. Frankly, I doubt if there are many plants that are better than the common aquarium plants in helping us to understand the role of plants in general.

Of course you know of the use made of elodea leaves to show the streaming of protoplasm in a plant cell, as seen through a compound microscope. If you maintain a simple aquarium with some elodea in it you will have suitable living material for ready use at any time.

The effect of absence of light may also be worthy of study in your plant-stocked aquarium. Cover an aquarium so that light cannot reach it and notice what effect this may have on the growth of plants in it.

No doubt you have had experiences in which an aquarium "went bad," and the plants began to die and to foul not only the water but the air near the water. Have you thought to use this as a demonstration of what happens in a large body of water that is unwisely managed?

Explore on the shore

In the fall children may want to explore the edges of bodies of water, examining the water plants that have drifted ashore. Many times great rafts of such material collect there. This may be caused by ducks that dive to the bottom and feed on the succulent winter storage areas, abandoning the major portion of the plant to float away. Let children explore these drifting masses to see if they cannot find for themselves some of the food storage areas. Make a collection of these for school and exhibition use. Such studies may lead to some genuine understanding of the role these plants play in maintaining a duck population. The story need not be academic if the teacher is alert to the possibilities of a weed-strewn shore.

The insert section gives some information on the geographic distribution of the plants under consideration, and suggests something of how some of these plants can survive in waters of different chemical composition. With this help, and a few local plants, this can help to enrich a geography lesson, bringing the plants of salt marshes and alkali lands into close association with the plants in your own local pools. Note, particularly, how the northern range of some of these plants is quite extensive, and this may help explain why the north country is so valuable as a reservoir and breeding ground for waterfowl.

Make a quick survey of the scientific names of these plants, and try to get some idea of why they bear such Latin names as *canadensis*, *marina*, *crispus*, *pectinatus*, *perfoliatus*, *palustris*, *flexilis*, *americana*, *dubia*, *demersum*, *caroliniana*, *vulgaris* and

myriophyllum. Each of these species names has a significant reference to the plant with which it is associated. Possibly a little investigation into this matter, using even the pictures alone, may help students feel that scientific names are not so bad after all. In drawing conclusions about the use of such terms as *caroliniana, canadensis, pennsylvanica* remember that these names were probably first used in Colonial times, and that the geographic areas with which they were associated have changed subsequently. Also, remember that probably the name was applied to a specimen that came from one of the colonies without any knowledge as to whether it was limited to that particular area, or was uniquely significant in connection with it. This suggests that we can bring a little history into our picture. Possibly when we recognize the role of pollution in affecting these plants, we may recognize that they are involved in the history that is in the making today.

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Life Science

By Thomas S. Hall and Florence Moog. New York. 1955. John Wiley and Sons. 502 pages. Illustrated. $6.50.

In preparing this college textbook of general biology the authors recognize that "the first task of any introduction to a science is to present the most significant data of that science." They point out that this can be done with special effectiveness if, "in addition to the data presented, some sense is conveyed of the activity through which they have been established. With this goal in mind, we have endeavored to give in parts of this book what may be called the narrative of biology, that is, the efforts of observation, speculation, and verification through which biologists are gradually forging an increased understanding of the living organism. Early in most chapters a basic problem, or group of problems, is identified, and the materials of the chapter are arranged partly to show how solutions to these problems have been and are being sought."

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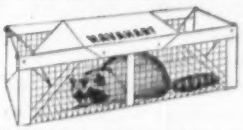

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Flower Cinderellas

(*continued from page 354*)

ther northward. Such a long flowering season is not common. However, mine grew between a foot and eighteen inches high.

The Missouri evening primrose, *Oenothera missouriensis*, which *Standardized Plant Names* rather absurdly names Ozark sundrops, measures four inches or more across, has light yellow, satiny petals atop a long, slender tube attached to a bright red stem. It grows in bare, dry, rocky soil from Missouri to Nebraska, Colorado and Texas. The name sundrops has long been used for certain, mostly small, yellow, diurnal species formerly classified under the genus *Kneiffa* in this large family of mostly four-petaled flowers. Texas children are prone to call even the pink or white evening primroses "buttercups." They also call the Missouri species "fluttermill," the four broad wings of the seedpods serving as the arms or paddles for juvenal power projects. Dipped in aluminum paint and supplied with chinaberry clappers, these pods become Christmas bells for wreaths and other holiday decorations. "Our" children are taught to shake out the seeds to help spread the supply of this perennial. Some prefer sprays of the natural pods, gray satin lining showing in the open top, creamy wings, often splashed with red. This species responds to good garden soil and extra summer watering by prolonging its flowering season through the summer, at a reduced rate of production, of course. The plant stems are weak and half-reclining, reaching a length of about two feet.

There are smaller, yellow evening primroses whose blossoms stay open all day. Some are actually low shrubs, at least in the southern parts of their ranges. But their stems are so slender and weak that I had *Oenothera serrulata* in my garden several years before I noticed that the slightly woody stems do live through the winter. This day primrose blooms all summer in the garden. It is a native from Manitoba and Minnesota to Wisconsin, Texas and New Mexico. There are several varieties or species closely similar to this one. Ours have flowers about two inches across with rather crepey petals and narrow, toothed scattered leaves; stems reach two feet or more but require stakes if upright plants are desired. A variety with a novel black spot in its heart is *O. spinulosa*.

Pink evening primroses, *Oenthera tetraptera*, grow only eight to twelve inches tall, the blooms open to a diameter of about two and one-half inches. They are native to Texas, Arizona and Mexico, but adaptable northward, where they may be increased by the spreading, perennial roots, even if they will not reproduce by seed. The larger *O. speciosa*, usually white but sometimes pale pink, is a similar flower, but this common species spreads so aggressively as to become a nuisance in flower beds. Evening primroses will last fairly well as cut flowers if brought indoors not long before or after the petals unfold in late afternoon, before the moths have had a chance to fertilize them.

Although the blue wild indigo, *Baptisia australis*, is well known in cultivation, there is a showy but seemingly neglected yellow-flowered species. The compact, bushy, two-foot plant is crowned in spring by many erect racemes, six to twelve inches long, of bright yellow, one-inch pea flowers. This is probably *B. villosa*, native from Virginia and North Carolina to Florida, Arkansas and east Texas. Seeds should certainly be collected, after marking the plants while in flower, and given trials in various soils and climates.

Dalea is a neglected genus of plants with silky-fringed heads or slender spikes of tiny yellow, white, or purplish pea flowers. Some airy species such as the slender Dalea, *D. enneandra*, with white, fringed flowers along the many wiry branches might well be called and used as an American babysbreath in place of the imported, European *Gypsophelia*. Or fairy plumes might be a good name for it. This prairie species is native from North Dakota and Iowa to Missouri, Texas and Colorado; it blooms from May to August. Other species have dense, pussy-willow-like heads. All daleas have small, pinnately compound leaves, although the smokethorn *Dalea*, or ghost-tree, of Arizona is almost leafless.

Full many a flower is born to blush unseen because the record of its discovery lies hidden under a blanket of technical terms and descriptions as flat and dry as the specimens which too often were the sole inspiration of the describer.

The prairie gentian, *Eustoma russellianum*, is the largest of our native gentians. The flaring trumpets are two to three inches broad and vary from blue-purple to pale lavender and, rarely, white. The leaves are smooth and covered with a whitish, waxy bloom. The plants are annuals, or often bloom a second year, in gardens at least. They are one to two and one-half feet tall, flower abundantly from May to August and are lasting as cut flowers. The last quality most endangers the species as it is often cut by huge tubfuls and sold even in grocery stores in cities. This gentian is a regal member of a proud family that can boast of some of the fairest, most refined and alas often exclusive members of the plant world. Several are difficult to grow in cultivation. Although this *Eustoma* is native from Nebraska to Louisiana, Colorado, Texas, New Mexico and Mexico, it is in the Violet Crown Garden Garden Club of Austin, Texas, that they have found their most able champions. Choosing the popular name, Texas bluebell, this club has discovered the secrets of propagating the tiny seeds—using no dirt to cover but keeping constant moisture in their seed flats—, brought them into their gardens and publicised their cause so successfully that a national garden-club conservation award went to this club. Tiny proofs of the value of their campaign are now specks of green waiting for spring under my home-made cold frame. If other garden clubs would do as much for endangered native flowers of their neighborhoods, a positive program of conservation would develop and would excel by far the published lists of "forbidden species." A negative program of merely refraining from picking is not enough.

The story of "Some Common Eastern Spring Flowers," in *Nature Magazine* for April, 1946, written by E. Laurence Palmer made such sensible and workable suggestions about the conservation of native plants that extracts should be reprinted and circulated for the benefit of all garden club members.- These women represent a powerful force that could be even more effectively used than at present to encourage and demand the preservation of many forms of wildlife on the basis of their aesthetic values. By emphasizing the positive phases of their conservation projects, they will inspire new zeal for the old motto: "Enjoy, do not destroy!"

Camera

(*continued from page 383*)

got better pictures. It rather detracts, I think, from a wild bear picture to have a car fender, or somebody's elbow, projecting into it.

The worst case of "buck fever" I ever had came while I was stalking an elk—along with half a dozen other camera fans—within fifty feet of the road. He was a magnificent creature with spreading antlers and fat, glossy body. He knew it, too, and he haughtily ignored us and our cameras as we scrambled through the underbrush trying to find the best angle from which to "shoot" him.

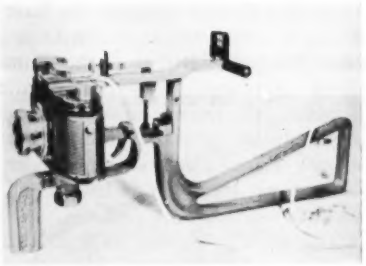
And as a friend of mine remarked later: "Wasn't it nice that so many people could take pictures and share in the enjoyment? But if they had been hunting with guns, one shot would have ended it all." And it was so true. We could all shoot with cameras, have a trophy to keep, and yet destroy nothing.

Yes, Yellowstone has much to offer. It has rivers and waterfalls—gentle rills and thundrous torrents like the Falls of the Yellowstone; it has the vast expanse of Yellowstone Lake and countless small pools sparkling in the sunlight. It has stately trees and spectacular rock formations. It has numerous mammals and birds, large ones and small ones. Some day I would like to go back and spend enough time to seek out the smaller, lesser known creatures. But it takes time to study them and to know their traits and their habitats. The same is true of any of our larger parks or wildlife refuges.

My visit to Yellowstone National Park was a too-brief but never-to-be-forgotten experience. And all I can say once more is: Hats off to the National Park Service! Here is hoping that it will continue in the future, as it has in the past, to preserve untouched and unchanged the beauty spots of America and the wildlife therein. That way, those of us who love Nature will always have a place to go, to see, and to photograph the things that are close to our hearts.

Gunning with a camera

FOR CAMERA HUNTERS, that is, for people who hunt with cameras instead of with guns, the Ditto Camera Corp., has announced a new-



type camera stock. Instead of using a cable release, this new device employs a lever that presses against the shutter release button, to give smooth, rapid action. A nose rest and shoulder rest combine to give the camera steadiness without a tripod. The stock is designed for the Ditto 99 rapid sequence camera, but it should be adaptable to other 35mm cameras as well. For further information, write the Ditto Camera Corp., 527 Fifth Avenue, New York 17, N. Y.

Plants without Flowers

By Harold Bastin. New York. 1955. Philosophical Library. 146 pages. Illustrated. $6.00. As is indicated by its title, this book deals with flowerless plants, the slime-fungi and bacteria, algae, lichens, the true fungi, mosses and liverworts, ferns, some fern allies, the horsetails and the club mosses. An introductory chapter treats with the beginnings and early history of plants in this group. The text is as popular as possible within the limitations of the subject.

Monkeys

By Herbert S. Zim. New York. 1955. William Morrow and Co. Illustrated by Gardell D. Christensen. $2.00.

This little book is one in the "Morrow Junior Books" series and is directed toward a quite young audience. It presents concisely introductory information about monkeys of both the old and new worlds, and about marmosets. Data is included on monkeys as pets.

This Is the German Shepherd

By William Goldbecker and Ernest H. Hart. Orange, Conn. 1955, Practical Science Publishing Co. 246 pages. Illustrated. $3.95.

Although this breed of dog has been the subject of numerous books in the past, it has not recently been considered. This, therefore, is a new book on the German Shepherd. It covers a wide range of information, from puppyhood to the future of the breed.

Interpretation Study

With funds given to it by an anonymous donor, the National Park Service is launching a survey and reappraisal of the basic principles and methods used in the far-flung interpretation-education program carried on throughout the National Park System. Freeman Tilden, of Warner, N. H., author of *The National Parks, What They Mean to You and Me*, a Knopf publication, has been selected by National Parks Director Conrad L. Wirth to pursue this study. Mr. Tilden, who has been for many years a collaborator with the National Park Service, has traveled extensively throughout the National Park system and has long interested himself in the many phases of the program on which he is now to concentrate his attention.

Referred to in recent years as the "interpretive program," this part of the Park Service's responsibility has become familiar to millions of visitors to the areas administered by the Service since it was officially launched in Yosemite National Park in the early 1920's.

"Freeman Tilden was chosen for this unusual assignment because of his preceptive understanding of the purposes of the National Park System," says Director Wirth. "We expect him to re-examine every phase of our interpretive work and its objectives; to analyze the many interpretive methods used; and to formulate recommendations directed toward improvement."

Begun with nature-guide service and evening "campfire programs," interpretive activities have been expanded throughout the National Park System to include museums, self-guiding trails and trips, roadside and trailside exhibits, electrical maps, recordings and a variety of other audio-visual aids, and special literature dealing with the history and natural history of the varied areas that comprise the National Park system.

While the study being undertaken by Mr. Tilden is primarily concerned with the National Park system, he will devote considerable attention also to State parks and other institutions which have undertaken interpretive activities of one kind or another. His study and the preparation of his report are expected to take approximately two years.

Wanderers

(*continued from page 377*)

the light can be turned on and off. The structure of these organs strikingly resembles some primitive eyes.

Phosphorescence is most noticeable in the sea during the darkest part of the night. This is not just because it is easier to see such light at this time but because of a curious behavior of the animals causing it. During the daytime, if one were to drag a small net at the surface of the water and thus collect the plankton, the total catch would be relatively small. At night, however, such a collection would obtain an abundance of creatures. This means that during the hours of daylight the plankton migrates to deeper water. As the light decreases at twilight the plankton moves again, this time towards the surface, where it remains until dawn.

The reasons for this migration are not yet completely understood. Light appears to be the most important factor involved, but temperature also plays a part. The reaction to these stimuli is not always the same, for a few animals show a reversed type of migration, moving towards the surface during the daytime and descending at night. In one species the young show such a reversed migration, while the adults migrate in the usual manner.

Knowledge of the behavior and habits of plankton is of the greatest importance to fishing industries the world over. Since many fish feed directly on the plankton, their seasonal abundance will depend on the abundance of the tiny planktonic animals. By sampling the plankton in any area, and basing the allowable catch of fish on the abundance of the food, overfishing and depletion of the stock can be prevented during a season in which the plankton growth is poor.

Dragon's Blood

(*continued from page 374*)

found in the writings of the Spanish physician Acosta in 1578, where it is recorded that the resin was already known to the Arabs, Persians, and Chinese. Among the first Europeans who knew the true botanical source of the resin was the German Vitus, who asserted that it came not from a tree but from a heavy cane. This report was confirmed by Rumphius who, in a letter written in the East Indies in 1689, told that this Dragon's Blood is derived from the fruits of a climbing, palm-like plant. Actually, the resin is obtained from eight or more species of prickly palms of the genus *Daemonorhops*, whose stems reach sixty feet in length and yield rattan canes.

The resin is present as a brittle layer over the surface of the cherry-size fruits. These are collected before they are fully ripe and are allowed to dry thoroughly. To dislodge the resin, the dry fruits are placed in baskets with cockleshells and shaken, or put into sacks and beaten with sticks. The resin is thus obtained as a gritty powder, which is sifted, softened by means of heat, and molded into sticks or cakes. Inferior grades often contain a good deal of fruit fragments or other debris. Two forms of the resin appear on the market: the "reed," molded into rods or sticks and wrapped with leaves; and the "lump," irregularly shaped masses. Palm Dragon's Blood is dull red, brittle, and easily crumbled into a crimson or orange-red powder. It dissolves readily in alcohol, producing an orange-red solution.

This, then, is the story of the *Dracaena* and *Daemonorhops* resins. Today, the collection of these resins in Socotra and Malaysia goes on much as it did centuries ago when their origin was obscured by myth and fable. Their present story can be summed up with the dry data of so much collected, imported, and exported. But not so their past. Resins derived from plants are many, but none can boast a more colorful history than the ones with the most imaginative name of all, Dragon's Blood.

Birds at Play

(*continued from page 351*)

apparent reason except the fun of it.

Many years ago, at Bloomington, Indiana, on a March morning I saw robins playing a sort of hide-and-seek. One hopped rapidly to a tree, where it hid in a hollow between roots and lay there close to the ground, so close, indeed, that when seeking the exact position of the bird, I nearly touched it with my hand before finding it. In the play, another robin came, but ran around the tree, stood on tiptoe, as it were, stretched its neck to peep over the root, and slyly went away. The first, after waiting for some time, flew silently to some bushes in a nearby hollow, whence it came back to find himself "it" in spying out a playmate.

In my early years at Washington, I noted cedarbirds, or waxwings, feeding on the barely reddening fruits of the European serviceberry. They ate eagerly, but twice I saw couples go through a queer performance. One, picking a berry, retained it near the tip of its beak, hopped to another bird, gave it the fruit, backed off, and awaited the same attention from its partner. This might be repeated a half-dozen or more times, when one of the birds swallowed the fruit. All this was done with great dignity and decorum.

The house, or English, sparrow, shown some years ago to be more related to the weaver-birds than to the sparrows, is an adaptable species that includes play in its repertory. At a Virginia feeding station, Fannie E. McAtee watched one of these birds on a garage roof from a window on the same level and not many feet away. It had a round seed in its bill, which fell, or was dropped, and rolled down the moderately sloping roof. The sparrow took to wing, alighted below the seed, watched it coming toward him, and while it was going past, snatched it up, flew up the slope and dropped it again. The seed rolled toward the side of the roof but was pushed back into its former course. The bird was seen to repeat this play a third time, after which recollection of the event is not clear.

In Nebraska, E. C. Jaeger saw English sparrows dropping pebbles from a gravelled roof, turning their heads to watch each pebble fall to a cement areaway below and to hear it hit. In the backyard where the seed-rolling was noted, the same observer saw one of these birds hopping from wicket to wicket of a wire fence, turning in direction each time, and thus reversing head and tail, proceed along the fence until out of sight—a distance of about seventy feet.

Such instances certainly are within the definition of actions not directly useful, hence qualify as play. In all, we may say that play is not an unknown, or even a rare, thing among birds, and that it is one of those links that should convince such a play-loving creature as man of their fellowship with him.

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Nature AND THE MICROSCOPE

By JULIAN D. CORRINGTON

"Sizes" Of Light

Some of the terms in common use that designate shafts of light of various diameters are employed in a purely figurative sense, yet we are so accustomed to them that we come to accept them as realities.

There can be no such thing, for example, as a "ray" of light in the scientific meaning of the term—to indicate a unit quantity or single line, as in making drawings of the path of light through prisms and lenses. If we think of light as a series of wave fronts advancing from a luminous source, then these are spherical and undulatory disturbances and completely unlike lines drawn with a ruler. On the other hand, if we think of a bombardment by photons, then the continuous nature implied by the word ray is wrong and, of course, the particles are ultra-subatomic in size and invisible. The modern view, of a stream of photons accompanied by wave action, does not lend itself to the coining of any terms of convenience, and such a word as ray we must have in order to talk about the behavior of light with reference to optical instruments. Ray-tracing, for instance, is the complex form of mathematics that describes what happens to light in traversing a series of lenses in a modern objective.

In general usage, a ray is any very narrow line of light and is drawn with a single line of a sharp pencil; in geometrical optics it is an ideal mathematical line, normal to a wavefront. A *beam* of light indicates a wider or larger bar than a ray; a *pencil* is a ray or narrow beam that is either converging or diverging; and a *cone* of light is a broader band, converging more abruptly.

Ray, beam, and shaft all have literary meanings which do not take the technicalities into account, and when we speak of a shaft of sunlight penetrating the forest gloom, everyone knows what is meant without the need of an explanatory diagram. However, literature too has its figments, and a ray of hope has neither more nor less reality than a gamma ray.

Arthropod Mountant

Turtox CMC-10 is a nonresinous mounting medium that has been developed primarily for the mounting of smaller arthropods or portions of larger ones. Fleas, ticks, mites, lice; mosquito larvae and small diptera; fern sori and sporangia also. The main requirements are that the material be unstained and not too transparent. The advantages are that the subjects may be placed in the mountant alive or freshly removed and from water, alcohol, glycerin or lactic acid. Specimens previously preserved may also be mounted.

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Beginner's Primer

The last two families of flies to be considered in this department are the Calliphoridae or Blowflies and the Sarcophagidae or Fleshflies. Remaining are the Glossinidae or Tsetse Flies and the Hippoboscidae or Louse Flies, both of which because of their more general interest and importance we are reserving for treatment as feature articles.

The two families here described have a number of common criteria. They average large as flies go, typical members resembling large house flies; the larvae are muscoid (like house fly maggots); and they may feed on offal or attack living prey throughout a wide range of both invertebrate and vertebrate victims or they may be active parasites. The better known forms are mostly too large and stout to make satisfactory whole mounts, and slide preparations are best limited to the many separate parts of larva and adult that we have often listed.

In the Calliphoridae, meaning "wearers of beauty," are those insects we commonly dub Blowflies and Bluebottle and Greenbottle flies, in which the body and especially the abdomen is a shiny, metallic blue or green. They buzz loudly on windowpanes and seem less clever than the house fly in evading capture or swatting. Best known are *the* Blowflies or Bluebottles, *Calliphora vomitoria* and *C. erythrocephala*, large bristly flies widely distributed over North America and Europe. *Lucilia caesar* is the Greenbottle, similar but smaller. The screw worm fly, *Cochliomyia macellaria* of most texts, is now thought to be a scavenger, according to Essig, and the palm as a dangerous pest passes to *C. americana*, the true Screw Worm fly of North and South America, that lays its eggs in open sores and wounds and thus brings on a severe myiasis in man or animals that is sometimes fatal.

In Africa are the Congo Floor Fly, *Auchmeromyia luteola*, and the Tumbu Fly, *Cordylobia anthropophagi*, the last name meaning "man-eater." In both the maggots feed on men and animals and can be very serious dangers.

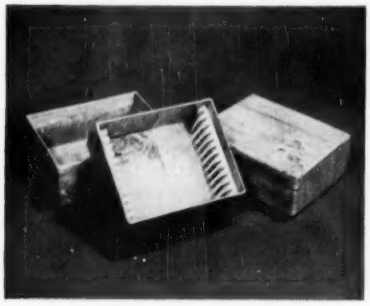
The Family Sarcophagidae (flesh-eater) includes the gray blowflies with large red eyes, dark longitudinal stripes on the thorax, and bristly abdomen. *Sarcophaga haemorrhoidalis* is one of the more familiar North American species. Ordinarilly it feeds upon dead organic matter, but sometimes has become a cause of myiasis in man. The intestinal flies in this family all deposit living larvae instead of eggs, and many are adept at this act; *Wohlfahrtia vigil*, for example, larviposits on the skin of children playing outdoors in certain parts of North America and can produce ugly-looking cases of cutaneous myiasis.

There will be at least some members of this family, which includes over a thousand species, to parasitize almost every sort of arthropod. There are parasites for spiders and spider egg cases, for scorpions, grasshoppers, beetles, and the nests of bees and wasps. Adult flies have been bred from eggs found in these and in snails, dead fish, excrement and a wide variety of other situations.

Of special interest in connection with these two families is the historical proof of biogenesis offered by Francesco Redi, court physician at Florence, in 1668. The proponents of spontaneous generation, a doctrine then in its heyday, claimed

that such creatures as maggots arose from putrefying materials as a result of the process of decay. Redi devised a celebrated experiment, one of the first on record using controls. He exposed a piece of meat in an open bottle, a second piece in a bottle covered only with a square of gauze, and a third in a tightly stoppered bottle. Blowflies, attracted by the odor, laid eggs on the meat of bottle 1, and these subsequently hatched into maggots. With bottle 2, since they could not get at the meat, they laid on the gauze, the eggs hatched, and the larvae soon died from lack of food. No flies came to bottle 3 at all. Thus blowflies played a part in this great controversy, unsettled till the time of Pasteur.

Blowflies have also come before the public eye in the recent past as a means of combating the dread osteomyelitis. This inflammatory condition of the bone marrow was treated in some hospitals by placing blowfly larvae in the infected marrow to clean it up, a ghastly procedure now fortunately outmoded with the discovery of the sulfas and antibiotics.



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You can always count on Ward's to come up with a new one. The management at this great supply house are ever alert to the development of novel items, from something small and inexpensive, as the present instance, to a large installment. The accompanying photo shows their new *Twelve-Pack* microslide container. This is a sturdy cardboard box, very handsome in its brown wood-grained pattern, provided with two slotted wood racks to hold a dozen slides securely. This is a much less expensive box than the all-wood type and is perfectly satisfactory for either shipping or storage. Send for one, and we guarantee you will be pleased and order more. Prices: each, 25c; doz., $2.75; hundred, $20.00; five hundred, $90.00. Address Ward's Natural Science Establishment, Inc., 3000 Ridge Road East, Rochester 9, N. Y.

The Turtle Moves

Anybody who is anybody in the world biological knows the famous *Turtox*, the creature that looks all turtle and not at all ox. He has been hanging out for many years at 761 East 69th Place, Chicago 37, where he has been standing erect, in most unchelonian posture, balanced on the tripod of his two hind legs and his stubby tail, holding the Earth on the tip of his snout.

Not long ago, feeling cramped in his quarters (all four of them), he put the Earth down and ambled off to resume his duties at a new location that promised more commodious surroundings. On page 65 of the March issue of *Turtox News* appears a portrait of Turtox, on his way to 8200 South Hoyne Ave., zone 20, where he has now resumed his arduous duty as upholder of this mundane sphere. Our enterprising photographer also snapped this hegira, and we herewith reproduce his interpretation of this testudinaceous journey.

Movie About Microscopes

For use by schools, colleges, and clubs, the Bausch & Lomb Optical Company will loan the new film it is sponsoring, entitled *The Compound Microscope*. Produced by Sturgis-Grant Productions, Inc., this is a sound motion picture in color that runs about twenty minutes. We have recently shown it before a large class in histology and found it to be exceedingly well organized, interesting and instructive.

A number of types of microscopes are illustrated, and then the medical model with inclined binocular body is used to demonstrate how to focus, how to secure proper illumination, correct care of the instrument, and use of oil immersion. Assembly of

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this microscope is done step by step, with explanations of the role of each part. How a microscope magnifies, the difference between real and virtual images, function of the condenser, and kindred topics are defined via animated diagrams, using rays of different colors in an effective manner. The split frame technique is also employed, one half of the picture showing the microscope, with the operator performing such a step as oiling the condenser to the slide, while the other half depicts what he sees when he looks down the tube,—a photomicro of tissue which, for instance, suddenly becomes clearer and yields better resolution when the operator makes the adjustment called for in the running commentary.

If you have charge of a group that would be interested by a film explaining what the microscope is and what it does, by all means write to the film service department of B & L, at Rochester 2, N. Y., and arrange to borrow this fine reel. There is no charge to authorized persons.

With the film comes a *Student's Manual for "The Compound Microscope,"* a fully illustrated and very instructive booklet of 48 pages concerning the film. Topics explained, with illustrations from the movie, are magnification, resolving power, illumination, parts of the microscope, focusing, care of the instrument, and finally there is a 17-page glossary of optical terms that will be highly useful to all students of the subject. This booklet is sold at 10c per copy in lots of not less than fifty per order.

New AO Student Scope

THOROUGHLY modern and streamlined is the new AO Laboratory Microscope No. 73, designed to provide a quality instrument at low cost. Every effort has been made to get the price down by eliminating nonessentials and redesigning basic parts. Made with school use in mind, the No. 73 is equally suitable for the amateur working alone. The stand is aluminum and the weight considerably lighter than usual, but a sturdy base gives ample stability. The finish is a novel and pleasing light gray, accented by the black stage, nosepiece, and adjustment knobs, and highlighted by the brightly colored objectives; green for the 10X and yellow for the 43X. Teachers will immediately see the utility in having the two objectives of different colors.

The most unusual feature is the single focusing adjustment, intermediate in movement between the customary coarse and fine adjustments. It has a spring-loaded train of gears that prevents racking down onto the slide, and this microscope is otherwise rendered fool-proof by locked-in spring clips, adjustment heads, objectives, and eyepiece. The stage has a disc diaphragm, and the mirror is single-surfaced, concave. The optics are excellent, yielding clear, crisp images and wide fields. The eyepiece is 10X and the instrument may be obtained with either 1, 2, or 3 objectives and corresponding nosepiece; 5X, 10X, and 43X.

No. 73S, the one we examined, has 10X and 43X objectives on a double revolving nosepiece, dual cone type, and is priced at $109.00. It comes in a sturdy cardboard shipping carton, but a regulation wooden case with lock and key can be obtained as an extra; also with a substage illuminator instead of a mirror, or with a bracket adapter to provide the use of both mirror and illuminator. The quantity discount will be attractive to schools; $98.10 each in lots of five or more. Contact the American Optical Company, Instrument Division, Buffalo 15, N. Y.

Long Time No See

IN TECHNIQUE manuals one may read such general statements as, "Properly fixed tissues may remain in Bouin's fluid indefinitely," or "Once embedded in paraffin, the tissue may be stored for years before sectioning." Doubtless all microscopists accept such remarks at their face value, but definite records are not abundant in the literature. Thus the following may have some merit on this score.

Dr. Lauren C. Gilman of the Department of Zoology, University of Miami, fixed a block of parotid gland in Bouin's, embedded in paraffin, sectioned the piece, and affixed the sections to slides in 1937. Having no immediate use for them, the slides were stored. In January, 1955, the slides were given to a class in microtechnique for practice in staining and mounting. Good clear slides resulted, both with hematoxylin and eosin and with Mallory's Triple. For all one could tell, the sections had been cut the day before.

Library Corner

THE PROFESSIONAL book reviewer, like the critic of art or music, sees productions that he believes to be good, bad, and indifferent. Inasmuch as books have already passed under a most careful editorial scrutiny, there are apt to be fewer poor ones than would be anticipated in other fields; the average performance should run high. In reviewing something in the neighborhood of five hundred publications, we have had occasion to praise much more often than to pan. A number,—perhaps a dozen,—we have deemed well nigh perfect: superbooks that go on and on through many editions and revisions. But until this time we have never found, we thought, perfection.

Our nomination for top honors is the revised edition of *College Botany*, by Harry J. Fuller and Oswald Tippo, of the University of Illinois; the drawings are by Elizabeth Derrough Kirk and Wilson Stewart, the two paintings by Natalie Harlan Davis, the excellent photographs by a numerous group whose aid is acknowledged, and the publishers, who share heavily in this accolade, are Henry Holt and Company.

From the binders, depicting a photomicro of wood, through the almost one thousand pages, this book has everything. It is beautifully printed and presented; there is complete and authoritative coverage of the subject; there is a fine balance between photograph and drawing, each to its proper sphere, and each of exceptional quality; there is a remarkably equable division of emphasis among the fields of morphology, physiology, taxonomy, and ecology, such that adherents of each school of presentation should be pleased; there are excellent chapters on distribution in time and space, on evolution, heredity, and economic botany; there is an unusually fine glossary of 27 pages. A small point we especially appreciated was the heading, at the end of each chapter, "Suggested Readings for Interested Students." The psychology of that adjective is terrific! Also following each chapter are topics and questions for study.

No teacher or student of botany can afford to miss at least an inspection of this beautifully written and illustrated text. Pp. xiv, 993; frontis. and 1 pl. in color; figs. 585. Henry Holt & Co., 383 Madison Ave., New York 17, 1954. $6.90.

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